NEW DATA UPDATE 4

NATIONAL SEMICONDUCTOR CORPORATION

JULY 1981

NEW DATA UPDATE 4

NATIONAL SEMICONDUCTOR CORPORATION

The New Data Update 4 is a service of National Semiconductor to keep you abreast of the latest products available. This issue features the first pages of data sheets published April through June 1981 (1 quarter). An alpha-numerical index by device number, an index by device function, a listing of new application notes and briefs are included in the front section.

Circle the appropriate update number on the business reply card (centerfold) and drop in the mailbox to receive the complete data sheet or publication of your choice. For any publication without an update number, please fill in application note number or brief number in blank spaces provided on reply card.

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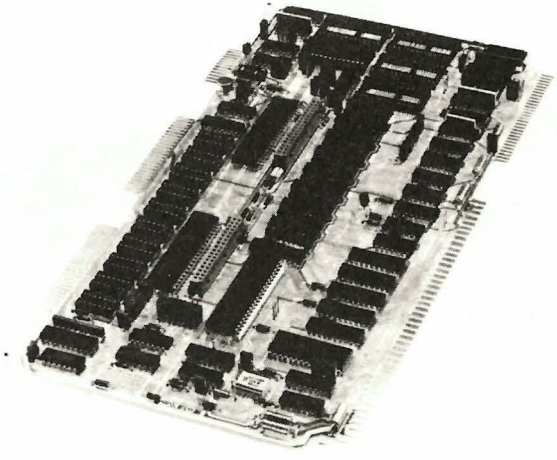
BLC-80/11A, BLC-80/12A, BLC-80/14A Series/80 Board Level Computers



- **Upward compatible with BLC-80/11 board level computer**
- **Two BLX bus connectors for on-board expansion with BLX series modules**
- **1 K, 2 K, and 4 K bytes of RAM**
- **Sockets for up to 32 K bytes of PROM**
- **48 programmable parallel I/O lines with sockets for interchangeable line drivers and terminators**
- **Programmable synchronous/ asynchronous communications port with selectable RS-232C or 20 mA current loop interface**
- **Single level interrupt with 16 interrupt sources**
- **Auxiliary power bus and power-fail interrupt control logic for RAM battery backup**
- **Limited master Multibus™ interface**
- **Compatible with industry standard BLC/SBC Series/80 hardware and software**
- **Plug replacement for SBC-80/10B**

Product Overview

The BLC-80/11A Family of Board Level Computers (BLC-80/11A, BLC-80/12A, BLC-80/14A) are members of a family of Series/80 products with the BLX interface. This interface (identical to the SBX standard) provides the means for economical expansion of on-board resources. The OEM can combine the BLC-80/11A with any of the BLX series of expansion modules and customize his application with off-the-shelf products from National Semiconductor Corporation.

The BLC-80/11A Family is essentially the BLC-80/11 Family (BLC-80/11, BLC-80/12, BLC-80/14) with several enhancements. These, in general, include two BLX connectors, support for 2764 PROMs, and battery backup logic.

Circle DATA UPDATE No. 1172

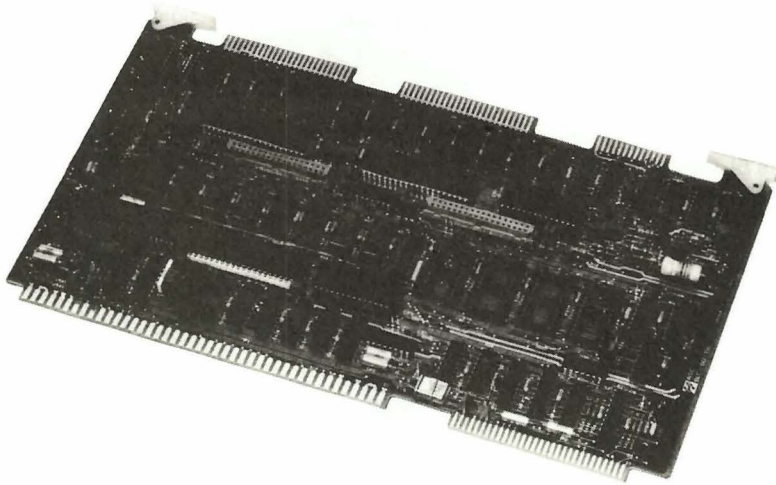
Functional Description

BLX Module Expansion Bus

The new BLX bus interface brings an entirely new dimension to system design, offering incremental, on-board expansion with small BLX modules. Two BLX bus connectors are provided to allow plug-in expansion with any BLX module. One may use these to expand existing on-board resources, or configure entirely new functions.

Examples of expanding existing BLC-80/11A resources would be adding the BLX-350 Parallel I/O Module, or the BLX-351 Serial I/O Module. These provide respectively 24 additional programmable parallel I/O lines, with sockets for user customization of

BLC-80/116
Series/80 Board Level Computer



- **Upward compatible with BLC-80/11 board level computer**
- **Two BLX bus connectors for on-board expansion with BLX Series modules**
- **16 K bytes of RAM**
- **Sockets for up to 16 K bytes of PROM**
- **48 programmable parallel I/O lines with sockets for interchangeable line drivers and terminators**
- **Programmable synchronous/ asynchronous communications port with selectable RS232C or 20 mA current loop interface**
- **Single level interrupt with 11 interrupt sources**
- **Auxiliary power bus for RAM battery backup**
- **Limited master Multibus™ interface**
- **Compatible with industry standard BLC/SBC Series/80 hardware and software**

Product Overview

The BLC-80/116 Board Level Computer is a member of a family of Series/80 products with the BLX interface. This interface (identical to the SBX standard) provides the means for economical expansion of on-board resources. The OEM can combine the BLC-80/116 with any of the BLX series of expansion modules and customize his application with off-the-shelf products from National Semiconductor Corporation.

The BLC-80/116 is essentially an enhanced BLC-80/11 combined with a BLC-016 RAM expansion board. The enhancements to the BLC-80/11 include two BLX connectors, sixteen kilobytes of RAM, and support for 2732 PROMs.

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Circle DATA UPDATE No. 1173

Functional Description

BLX Module Expansion Bus

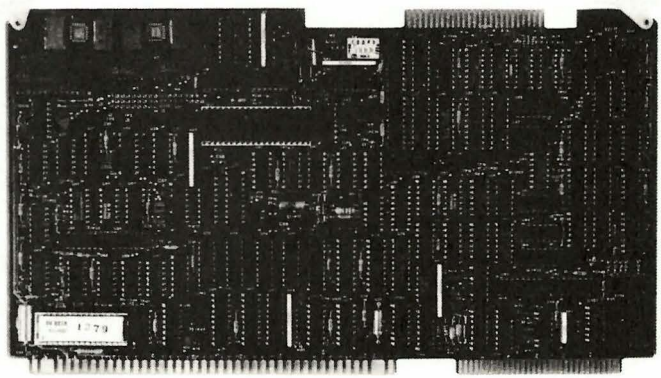
The new BLX bus interface brings an entirely new dimension to system design, offering incremental, on-board expansion with small BLX Modules. Two BLX bus connectors are provided to allow plug-in expansion with any BLX module. One may use these to expand existing on-board resources, or configure entirely new functions.

Examples of expanding existing BLC-80/116 resources would be adding the BLX-350 Parallel I/O Module, or the BLX-351 Serial I/O Module. These provide, respectively, 24 additional programmable parallel I/O lines, with sockets for user customiza-

National Semiconductor

May 1981

BLC-8488
Intelligent GPIB Controller Board



- **Provides communications between GPIB-compatible instruments/devices and the Multibus™**
- **Does not require in-depth knowledge of GPIB**
- **Conforms to IEEE standard 488-1978 interface**
- **Maximum GPIB data transfer rate of 1 MB/s with board throughput rate of 125 KB/s**
- **2 KB of public, dual-port RAM mappable anywhere in the 1 MB memory space**
- **Can address up to 1 MB system memory**
- **Jumper-selectable GPIB configuration for all modes specified in IEEE 488-1978**
- **Primary and secondary address handling capability**
- **Up to 8 KB of ROM/PROM control firmware storage (only 4 KB required by supported firmware)**
- **1 KB of private RAM**
- **Flexible interrupt handling/generation arrangement**
- **Multimaster capability**
- **Cable included for connection to male and/or female GPIB connectors**
- **Compatible with industry standard BLC/SBC Series/80 hardware and software**

Product Overview

The BLC-8488 Intelligent GPIB Controller is a single-board solution for communications over, and control of, the General Purpose Interface Bus from a Multibus-based system. It conforms to all aspects of the IEEE 488-1978 specification. Since it contains its own intelligence, in-depth knowledge of the GPIB is not required. Instead, one merely configures IOCB's (I/O Control Blocks) from which all operations on the GPIB are derived.

There are now hundreds of instruments, devices, and computer peripherals compatible with the GPIB. Via the use of the BLC-8488, one can quickly configure a variety of systems, such as production test, lab experiments, data collection, instrumentation systems, and many more. Even one-shot test systems are easily constructed, with many of the details of GPIB operation being transparent to the system programmer.

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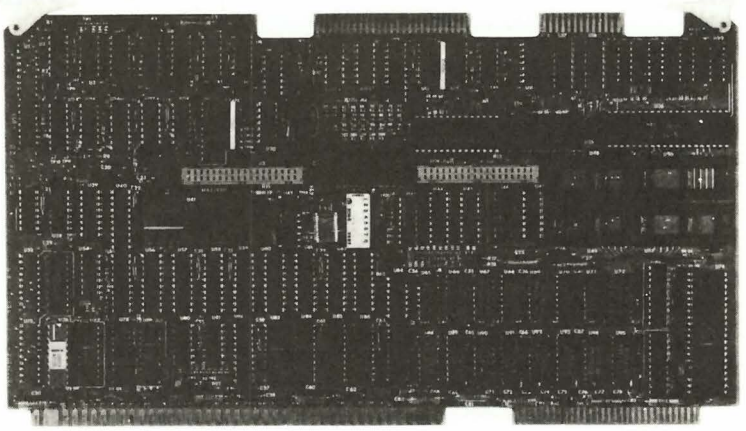
Circle DATA UPDATE No. 1174

National Semiconductor

May 1981

BLC-86/12B
Board Level Computer



- 8086 16-bit microprocessor central processing unit
- 32 K bytes of dual-port read/write memory expandable on-board to 64 K bytes with on-board refresh
- Sockets for up to 32 K bytes of read only memory
- System memory expandable to 1 megabyte
- 24 programmable parallel I/O lines with sockets for interchangeable line drivers and terminators
- Programmable synchronous/ asynchronous RS232C compatible serial interface with software selectable baud rates
- Two programmable 16-bit BCD or binary timers/event counters
- Two BLX connectors for on-board I/O expansion
- 9 levels of vectored interrupt control, expandable to 65 levels
- Auxiliary power bus and power fail interrupt control logic for read/write memory battery backup
- Multibus™ interface for multimaster configurations and system expansion
- Dual port RAM with lock-out capability for system security
- Compatible with Series/80 family board level computers, memory, digital and analog I/O, and peripheral controller boards

Product Overview

The BLC-86/12B Board Level Computer is a member of National Semiconductor Corporation's complete line of OEM microcomputer systems which take full advantage of the latest LSI technology to provide economical, self-contained, computer-based solutions for OEM applications. The BLC-86/12B board is a complete computer system on a single 6.75 × 12.00-inch printed circuit card. The CPU, system clock, read/write memory, non-volatile read only memory, I/O ports and drivers, serial communications interface, priority interrupt logic and programmable timers, all reside on the board. Full Multibus interface logic is included to offer compatibility with the Series/80 family of board level computers, expansion memory options, digital and analog I/O expansion boards and peripheral controllers. Two BLX bus compatible connectors are also provided for incremental on-board expansion with the growing line of BLX expansion modules from National Semiconductor Corporation.

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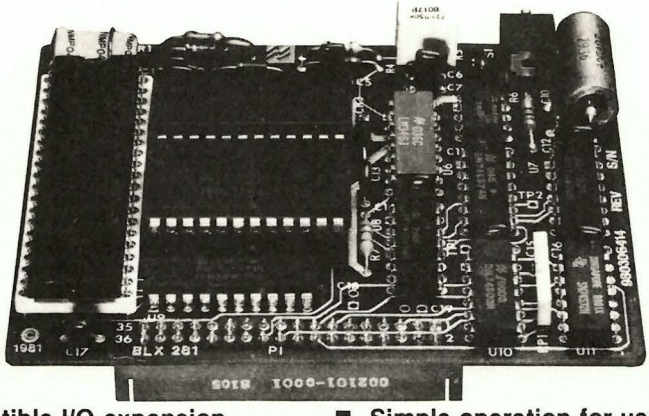
Circle DATA UPDATE No. 1175

BLX-281
Speech Synthesis Expansion Module



- **BLX bus-compatible I/O expansion**
- **Speech synthesis based on DIGITALKER™**
- **Large vocabulary adequate for most applications**
- **On-board filter and half-watt amplifier**
- **Simple operation for user**
  - I/O write with word/sound address
  - Interrupt asserted when complete
- **BLX bus on-board expansion elimates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-281 Speech Synthesis Expansion Module is a member of the new line of BLX bus-compatible expansion module products from National Semiconductor Corporation. The BLX-281 plugs directly into any BLX bus-compatible host board offering low cost incremental on-board expansion. As a result, any BLX bus-compatible host board may be given the ability to "speak". By merely adding a speaker to a system containing the BLX-281, many users can do away with CRTs, printers, rows of LEDs, or similar communications devices. This lowers the cost of most systems, and has the added benefit of removing messages which are potentially ambiguous and hard-to-understand for untrained users. The BLX-281 contains 144 words, sounds, tones, and durations of silence, each of which has a unique address. A table of addresses (desired words/sounds) is built, and passed to the BLX-281. An on-board filter and amplifier provide the actual speech signal to a standard miniature phone jack. The BLX module is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance, and frees Multibus system traffic for other system resources. Incremental power dissipation is minimal, requiring only 3.7 watts.

DIGITALKER is a trademark of National Semiconductor Corp.

Functional Description

The BLX-281 Speech Synthesis Expansion Module uses the MM54104 Speech Processor Chip from National Semiconductor Corporation. The digitized and compressed speech data are contained in an MM52164 Maxi-ROM. The system software communicates with the BLX-281 across the BLX bus using I/O read/write commands.

Vocabulary

The standard vocabulary set offered on the BLX-281 is shown in Table I, along with the assigned addresses for each item. By combining the appropriate words, sounds, tones, and silence durations, speech can be generated to satisfy many applications.

Words required, but not found in the table, can frequently be built. Examples of this are: combine "RE" with "SET" for "RESET", or combine "DEGREE" with "SS" for "DEGREES".

In normal human speech, the brain puts durations of silence between the words to make the sentence flow smoothly. This is provided for in the BLX-281 (see Table I). A suggestion for improved phrase quality is to insert 80 milliseconds of silence prior

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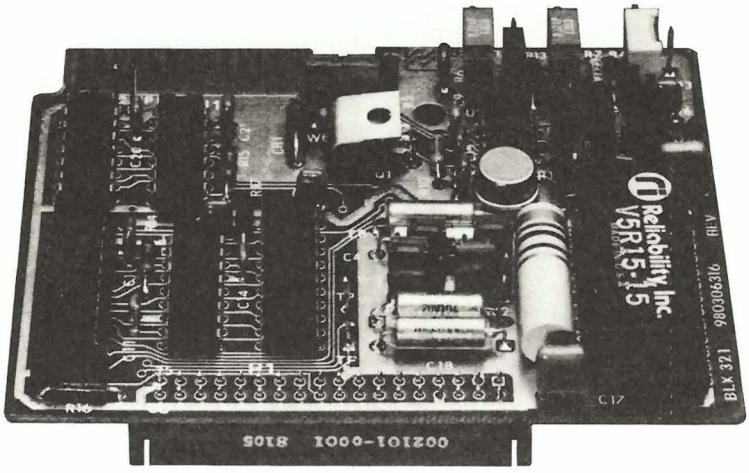
BLX-321
Analog Output Expansion Module



- **BLX bus-compatible I/O expansion**
- **Single channel of digital-to-analog conversion**
- **10-bit resolution with high accuracy**
- **Concurrent voltage and current modes**
- **Single +5V DC power required**
- **BLX bus on-board expansion eliminates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-321 Analog Output Expansion Module is a member of the new line of BLX bus-compatible expansion modules from National Semiconductor Corporation. The BLX-321 plugs directly into any BLX bus-compatible host board offering incremental on-board expansion. The BLX-321 provides a single channel of digital-to-analog conversion. Ten-bit resolution is provided with an accuracy of 0.05% of the desired output plus ½ LSB. Current and voltage modes are simultaneously provided. An on-board DC-to-DC converter provides all required voltages from the $+5V_{DC}$ on the BLX bus. The user can optionally provide his own power if his application requires high voltage compliance into large loads. The BLX board is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. In addition, incremental power dissipation is minimal, requiring only 3.5 watts.

Multibus is a trademark of Intel Corp.

Circle DATA UPDATE No. 1177

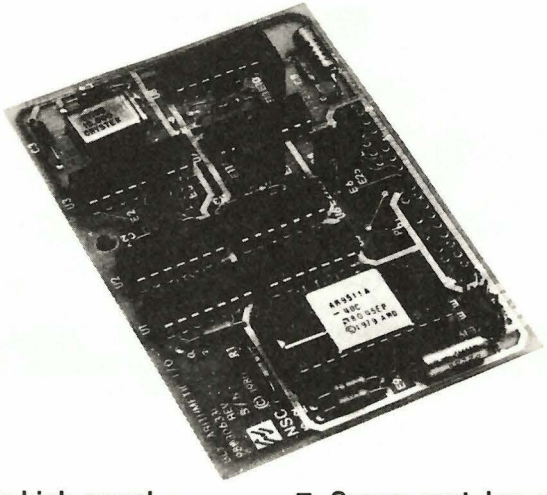
Functional Description

Analog Section

The BLX-321 Analog Output Expansion Module uses a DAC1006 digital-to-analog converter from National Semiconductor Corporation to provide a single analog output channel. The output is a constant current (4 to 20 mA) and a constant voltage (0 to 10 V). The 10-bit resolution offers 0.16 μA steps in the current mode and 10 mV steps in the voltage mode.

The output connector (J1) is a 26-pin edge connector that mates with flat, woven, or round cable. By using different combinations of output pins, the user selects which current or voltage modes are desired (different modes allow for differing burdens). The connection for the optional user-supplied power (for current mode into high loads) is also on J1.

BLX-331
Fixed/Floating Point Math Expansion Module



- **BLX bus compatible high speed fixed/floating point math expansion**
- **4 MHz operation**
- **Fixed point single and double precision (16/32-bit)**
- **Floating point double precision (32-bit)**
- **Binary data formats**
- **Add, subtract, multiply, and divide**
- **Trigonometric and inverse trigonometric functions**
- **Square root, log, and exponential functions**
- **Float to fixed and fixed to float conversions**
- **End of operation interrupt**
- **Software reset control**
- **Low power requirements**
- **BLX bus on-board expansion eliminates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-331 Fixed/Floating Point Math Expansion Module is a member of the new line of BLX bus-compatible expansion module products from National Semiconductor Corporation. The BLX-331 plugs directly into any BLX bus-compatible host board offering low cost incremental on-board expansion. As a result, any BLX bus-compatible host board may be expanded to perform high speed math computations, affording up to a 40 times improvement in speed compared to software math. The BLX-331 module performs single/double (16/32-bit) precision fixed point plus double (32-bit) precision floating point arithmetic operations. In addition, the module performs transcendental, data manipulation, and fixed-to-float/float-to-fixed point conversion operations. The command operations run entirely independent of the host board permitting efficient concurrent processing. The BLX module is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. Incremental power dissipation is minimal, requiring only 2.73 watts.

Functional Description

The BLX-331 module uses the 8231 Arithmetic Processing Unit (APU) to accomplish high speed (4 MHz) math operation. The system software may communicate with the BLX-331 module across the BLX bus using I/O read/write commands. All transfers, including operand, result, status, and command information, take place over an 8-bit bidirectional data bus. Operands are pushed onto an

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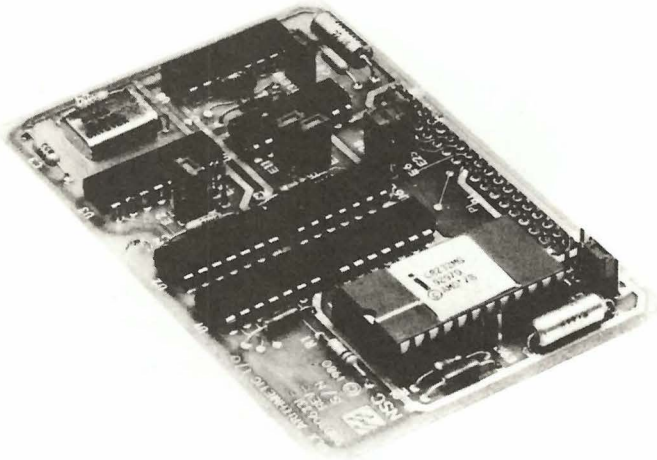
Circle DATA UPDATE No. 1178

BLX-332
Floating Point Math Expansion Module



- **BLX bus-compatible high speed floating point math expansion**
- **Compatible with proposed IEEE format**
- **Single (32-bit)/double (64-bit) precision arithmetic and data manipulation commands**
- **Add, subtract, multiply, and divide functions**
- **Performs functions independently and concurrently with the Multibus™ host board**
- **End-of-operation and error interrupts**
- **Stack oriented operand storage**
- **Software reset control**
- **Accessed as I/O port locations**
- **Low power requirements**
- **BLX bus on-board expansion eliminates Multibus system bus latency and increases system throughput**

Product Overview

The BLX-332 Fixed Point Math Expansion Module is a member of the new line of BLX bus-compatible expansion module products from National Semiconductor Corporation. The BLX-332 plugs directly into any BLX bus-compatible host board offering incremental on-board expansion. The BLX-332 module performs single (32-bit) and double (64-bit) precision floating point add, subtract, multiply, and divide functions compatible with the proposed IEEE floating point standard. The command operations run entirely independent of the host board permitting efficient concurrent processing. The BLX board is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. In addition, incremental power dissipation is minimal, requiring only 2.0 watts.

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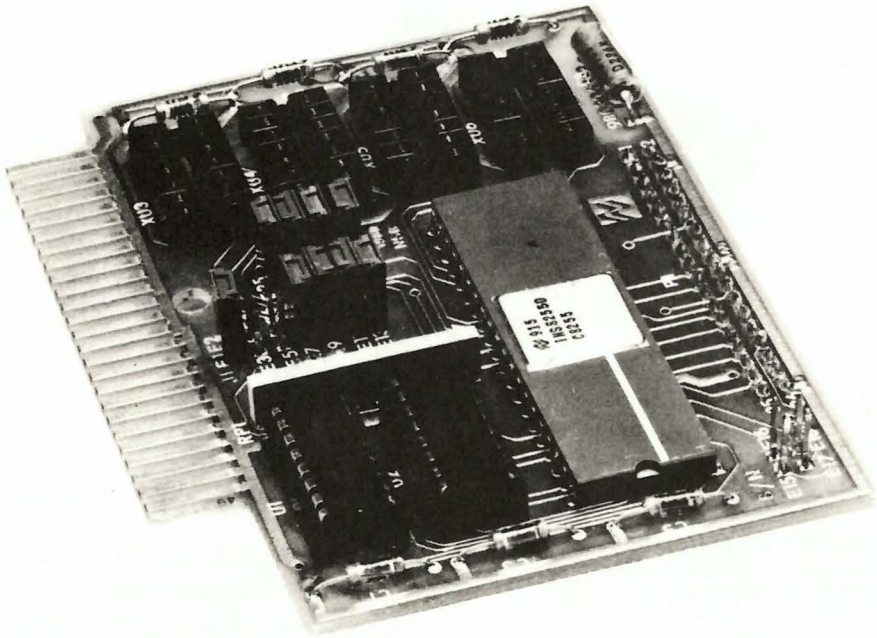
Circle DATA UPDATE No. 1179

Functional Description

The BLX-332 module uses the 8232 Floating Point Processor (FPP) to accomplish high speed math operation. The system software may communicate with the BLX-332 module across the BLX bus using I/O read/write commands. All transfers, including operand, result, status, and command information, take place over an 8-bit bidirectional data bus. Operands are pushed onto an internal stack and commands are issued to perform operations on the data stack. Results are then available to be retrieved from the stack. A status byte may be read to monitor execution completion and the nature of the result (zero, sign, or errors). In addition, control logic is included on the BLX-332 module to facilitate single instruction software reset control.

BLX-350
Parallel I/O Expansion Module



- **BLX bus compatible I/O expansion**
- **24 programmable I/O lines with sockets for interchangeable line drivers and terminators**
- **Three jumper selectable interrupt request sources**
- **Accessed as I/O port locations**
- **Single +5V lower power requirement**
- **BLX bus on-board expansion eliminates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-350 Parallel I/O Expansion Module is a member of the new line of BLX bus compatible expansion modules from National Semiconductor Corporation. The BLX-350 plugs directly into any BLX bus compatible host board offering incremental on-board expansion. The BLX-350 module provides 24 programmable I/O lines with sockets for interchangeable line drivers and terminators. The BLX board is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. In addition, incremental power dissipation is minimal, requiring only 1.6 watts (not including optional driver/terminators).

Multibus is a trademark of Intel Corp.

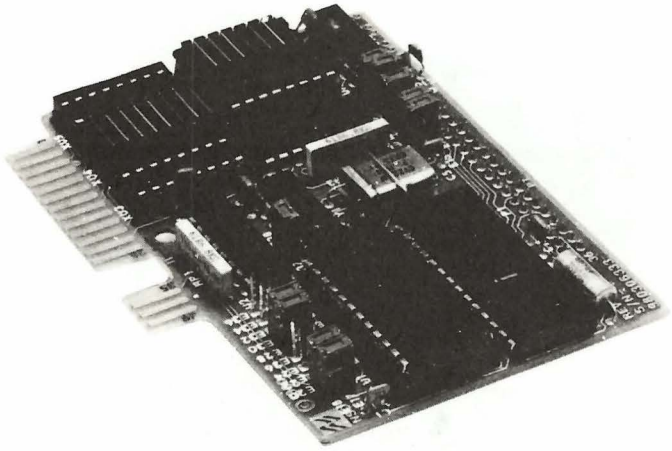
Circle DATA UPDATE No. 1180

Functional Description

Programmable Interface

The BLX-350 module uses an 8255A-5 Programmable Peripheral Interface (PPI) providing 24 parallel I/O lines. The base-board system software is used to configure the I/O lines in any combination of unidirectional input/output and bidirectional ports indicated in Table I. Therefore, the I/O interface may be customized to meet specific peripheral requirements. In order to take full advantage of the large number of possible I/O configurations, sockets are provided for interchangeable I/O line drivers and terminators. Hence, the flexibility of the I/O interface is further

BLX-351
Serial I/O Expansion Module



- **BLX bus compatible I/O expansion**
- **Programmable synchronous/ asynchronous communications channel with RS232C or RS449/442 interface**
- **Software programmable baud rate generator**
- **Two programmable 16-bit BCD or binary timers/event counters**
- **Four jumper selectable interrupt request sources**
- **Accessed as I/O port locations**
- **Low power requirements**
- **Single +5V when configured for RS449/442 interface**
- **BLX bus on-board expansion eliminates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-351 Serial I/O Expansion Module is a member of the new line of BLX bus compatible expansion module products from National Semiconductor Corporation. The BLX-351 plugs directly into any BLX bus compatible host board offering incremental on-board I/O expansion. The BLX-351 module provides one RS232C or RS449/442 programmable synchronous/asynchronous communications channel with software selectable baud rates. Two general purpose programmable 16-bit BCD or binary timers/event counters are available to the host board to generate accurate time intervals under software control. The BLX board is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. In addition, incremental power dissipation is minimal, requiring only 3.3 watts (assumes RS232C interface).

Multibus is a trademark of Intel Corp.

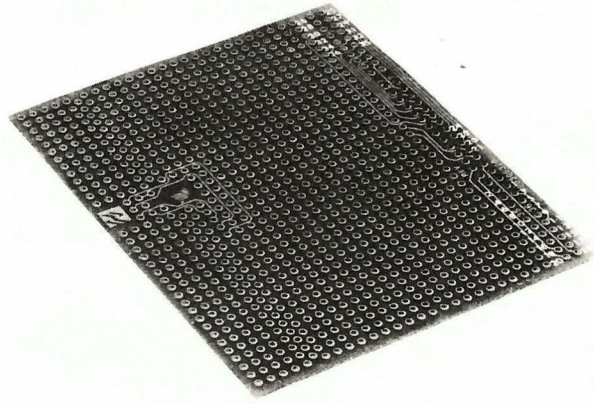
Circle DATA UPDATE No. 1181

Functional Description

Communications Interface

The BLX-351 module uses the 8251A Universal Synchronous / Asynchronous Receiver / Transmitter (USART) providing one programmable communications channel. The USART can be programmed by the system software to individually select the desired asynchronous or synchronous serial data transmission technique (including IBM Bi-Sync). The mode of operation (i.e. synchronous or asynchronous), data format, control character format, parity, and baud rate are all under program control. The 8251A provides full duplex, double buffered transmit and receive capability. Parity, overrun, and framing error detection are all incorporated in the USART. The command lines, serial data lines, and signal ground lines are brought out to a double edge connector configurable for either an RS232C

BLX-391
Prototyping Expansion Module



- **BLX bus-compatible expansion**
- **Permits easier user construction of custom circuitry for BLX/BLC systems**
- **Capacity for up to fourteen 16-pin equivalent integrated circuits**
- **Components can be socketed or flow soldered**
- **Provisions for right-angle card edge connectors can accommodate up to 120 pins for user-defined I/O**
- **BLX bus on-board expansion eliminates Multibus™ system bus latency and increases system throughput**

Product Overview

The BLX-391 Prototyping Expansion Module is a member of the new line of BLX bus-compatible expansion module products from National Semiconductor Corporation. The BLX-391 plugs directly into any BLX bus-compatible host board offering low cost incremental on-board expansion capabilities. As a result, any BLX bus-compatible host board may be expanded to perform any function that a user can incorporate onto a single-size (2.85″ × 3.70″) board. The BLX-391 can accomodate up to fourteen 16-pin equivalent integrated circuits, which can either be soldered or socketed. Wire-wrapping is accomplished on the component side of the board with individual wire-wrap pins or with wire-wrap strips. Card edge connectors are application-dependent, so provision is made to accomodate right angle connectors up to 120 pins. The BLX expansion module is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance and frees Multibus system traffic for other system resources. The BLX-391 comes in kit form, providing the bare printed circuit board, a male BLX connector, and nylon mounting hardware.

Circle DATA UPDATE No. 1182

Functional Description

The BLX-391 Prototyping Expansion Module is a general purpose prototyping printed circuit board, of traditional design, which meets the BLX single-size (2.85″ × 3.70″) form factor. A male BLX connector is included to allow connection to a BLX bus-compatible, Series/80 host board consistent with the design criteria followed on the entire family of BLX expansion module products.

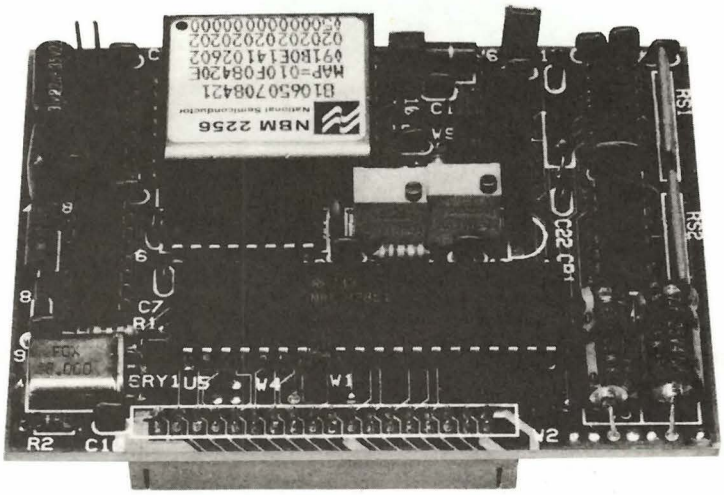
BLX Bus

The BLX bus interface provided on BLX bus-compatible Series/80 host boards conforms to those signals listed in Table 1. With the exception of several signals (such as MPST/—Module Present), all signals are merely extensions of the microprocessor bus, and, as such, meet the specifications for that microprocessor. The custom circuitry must be designed to be compatible with the actual BLX bus interface on the BLX bus-compatible Series/80 host board being used. (Any questions concerning the BLX bus should be addressed to your local Field Applications Engineer.)

National Semiconductor

PRELIMINARY
May 1981

BLX-9252
32K-Byte Bubble Memory Expansion Module Board



- **BLX bus-compatible memory expansion module**
- **Smallest bubble memory subsystem**
- **32K-bytes non-volatile storage**
- **5.8 ms average access time**
- **Error detection and correction**
- **Removable**
- **Polled, interrupt, or DMA data transfers**
- **Operation to 70°C**

Product Overview

The BLX-9252 is a member of the new line of BLX bus-compatible expansion module products from National Semiconductor. The BLX-9252 plugs directly onto any BLX bus-compatible host board offering low cost, incremental, on-board expansion. National offers several BLX bus-compatible host boards, such as the BLX-86/12B, BLX-80/11A/12A/14A, and BLX-80/116. The board offers the reliability and non-volatility of bubble memory technology, coupled with compatibility to the popular and convenient BLX bus.

The BLX-9252 features 32K-bytes of non-volatile storage capacity that can be configured into either 64-byte pages or 256-byte sectors. Data reliability is reinforced with a 12-bit Fire Code capable of detecting up to three random errors or an error burst up to 12 bits in length, and capable of correcting any error bursts of up to 3 bits in length. Data transfer can be accomplished in either polled or interrupt driven modes; or the BLX-9252 can be used as a channel to a DMA controller located on the host board. The BLX module is closely coupled to the host board through the BLX bus, and as such, offers maximum on-board performance, freeing the host system's bus traffic for other system resources. Incremental power consumption is minimal, requiring only 4.6 watts.

Circle DATA UPDATE No. 1183

Functional Description

Figure 1 is a functional block diagram of the BLX-9252. The board uses the NBM2256 Bubble Memory, its associated interface circuits, and the NBC82851 Bubble Memory Controller, all from National Semiconductor Corporation. The NBM2256 Bubble Memory provides 256K-bits of non-volatile storage which is formatted into 32K-bytes by the NBC82851 Controller. The Bubble Memory Controller generates the complex timing necessary to drive the Bubble Memory and also provides the user interface. The system

National Semiconductor

APRIL 1981

COP400-PDS Product Development System

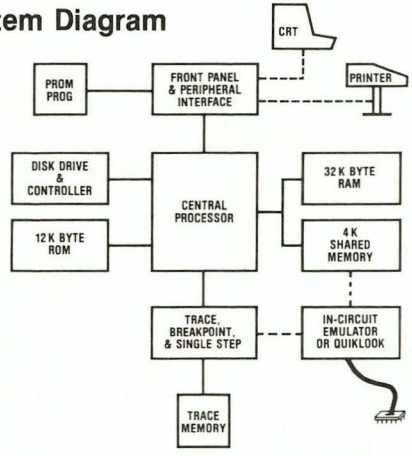
General Description

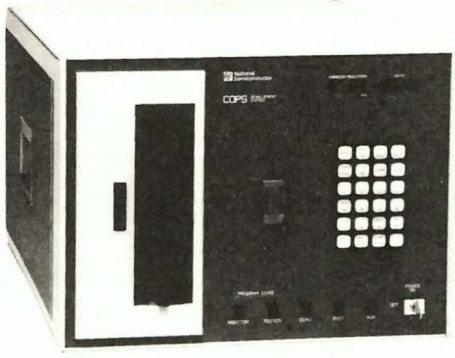
A single development tool which supports microcontroller development activities through every phase from concept to production, the COP400 Product Development System is built around a powerful 16-bit microcomputer to allow rapid execution of sophisticated, efficient utilities. The sytem meets the *total* product development need. An editor and assembler are provided to handle source code entry, conversion to object code, and maintenance of documentation. The emulator card attachment allows object code to be executed under the careful control of the COPMON debug utility. A cable can be connected from the PDS to the final product; in this mode, the full power and versatility of the PDS is extended to the product-to-be for real time emulation during development. When a program is complete and ready to be committed to production, the PDS generates a transmittal disc that NSC will use to assure accurate masking of the final components. The usefulness of the PDS does not end there: a fixture is available for the incoming functional test of the ROM programmed COP400 devices. Thus, the COP400-PDS actively supports every step of a microcontroller product development activity.

Features

- Supports the entire COP400 and COP300 microcontroller family
- A *total* concept-to-production tool
- Low cost
- 32k bytes R/W memory
- 12k bytes PROM (firmware)
- Disk-based
- Macro-assembler
- RS-232 and current loop peripheral interfaces
- Automatic baud rate selection (110-9600)
- Comprehensive in-system emulation (ISE™), with single-step, breakpoint & trace
- QUIKLOOK™, a functional test module for incoming inspection
- ROM pattern transmission by diskette

System Diagram





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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

National Semiconductor

May 1981

DAC1280A, DAC1280 12-Bit Digital-to-Analog Converters

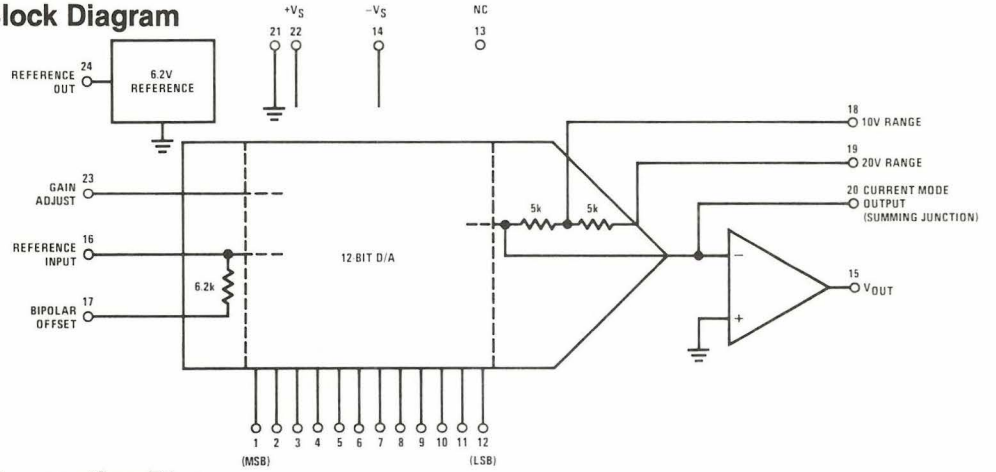
General Description

The DAC1280 series is a family of precision, low cost, fully self-contained digital-to-analog converters. The devices include 12 precision current switches, a 12-bit thin film resistor network, output amplifier, buffered internal reference, and several precision resistors, which allow the user to tailor his system needs to accommodate a variety of bipolar and unipolar output voltage and current ranges. Logic inputs are TTL, DTL and CMOS compatible, and are complementary binary (CBI) format. In all instances, a logic low ($\leq$0.8V) turns a given bit ON, and a logic high ($\geq$2V) turns a given bit OFF. Internally supplied resistor options provide low drift bipolar output voltage ranges of $\pm$2.5V, $\pm$5V, $\pm$10V, and unipolar ranges of 0V to 5V or 0V to 10V. Current mode output is 0 mA to 2 mA.

Features

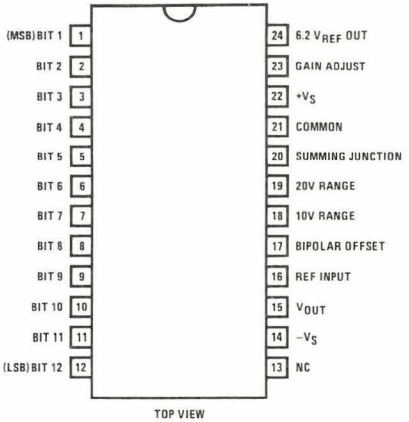
- Completely self-contained with internal reference and output amplifier
- High reliability exact replacement for DAC80-CBI-V or DAC80Z-CBI-V
- $\pm$1/2 LSB linearity max over 0°C to 70°C temperature range for DAC1280A
- $\pm$2.5V, $\pm$5V, $\pm$10V, 0V to 5V, 0V to 10V voltage outputs
- 0 mA to 2 mA current output
- Fast settling time: 300 ns current mode; 2.5 μs voltage mode
- Standard 24-pin IC package
- Low cost
- TTL CMOS compatible binary input logic over temperature

Block Diagram



Connection Diagram

Dual-In-Line Package



TOP VIEW

Circle DATA UPDATE No. 1185

National Semiconductor

ADVANCED INFORMATION
AUGUST 1980

DP8341 Serial Bi-Phase Receiver/Decoder

General Description

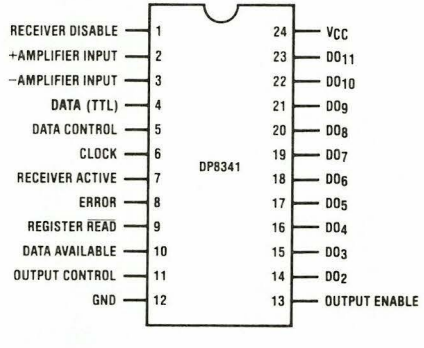
The DP8341 provides complete decoding of data for high speed serial data communications. In specific, the DP8341 recognizes serial data that conforms to the IBM 3270 Information Display System Standard and converts it into ten (10) bits of parallel data. Although this standard covers Bi-Phase serial data transmission over a coax line, this device easily adapts to generalized high speed serial data transmission on other than coax lines at frequencies either higher or lower than the IBM 3270 standard.

The DP8341 receiver and its complementary chip, the DP8340 transmitter, are designed to provide maximum flexibility in system designs. The separation of transmitter and receiver functions allows addition of more receivers at one end of the Bi-Phase line without the necessity of adding unused transmitters. This is advantageous specifically in control units where typically Bi-Phase data is multiplexed over many Bi-Phase lines and the number of receivers generally outnumber the number of transmitters. The separation of transmitter and receiver function provides an additional advantage in flexibility of data bus organization. The data bus outputs of the receiver are TRI-STATE®, thus enabling the bus configuration to be organized as either a common transmit/receive (bi-directional) bus or as separate transmit and receive busses for higher speed.

Features

- DP8341 receives ten (10) bit data bytes and conforms to the IBM 3270 Interface Display System Standard
- Separate receiver and transmitter provide maximum system design flexibility
- Internal parity detection
- High sensitivity input on receiver easily interfaces to coax line
- Standard TTL data input on receiver provides generalized transmission line interface and also provides hysteresis
- Data holding register
- Multi-byte or single byte transfers
- TRI-STATE® receiver data outputs provide flexibility for common or separated transmit/receive data bus operation
- Data transmission error detection on receiver provides for both error detection and error type definition
- Bi-polar technology TTL input/output compatibility with excellent drive characteristics
- Single +5V power supply operation

Connection Diagram



Circle DATA UPDATE No. 1186

National Semiconductor

JUNE 1981

DP8350 Series CRT Controllers

General Description

The DP8350 Series of CRT Controllers are single-chip bipolar (I^2L technology) circuits in a 40-pin package. They are designed to be dedicated CRT display refresh circuits. Three standard products are available, designated DP8350, DP8352, DP8353. Custom devices, however, are available in a broad range of mask programmable options.

The CRT Controller (CRTC) provides an internal dot rate crystal controlled oscillator for ease of system design. For systems where a dot rate clock is already provided, an external clock may be inputted to the CRTC. In either case system synchronization is made possible with the use of the buffered Dot Rate Clock Output.

The DP8350 Series has 11 character generation related timing outputs. These outputs are compatible for systems with or without line buffers, using character ROMs, or DM86S64-type latch/ROM/shift register circuits.

12 bits (4k) of bidirectional TRI-STATE® character memory addresses are provided by the CRTC for direct interface to character memory.

Three on-chip registers provide for external loading of the row starting address, cursor address, and top-of-page address.

A complete set of video outputs is available including cursor enable, vertical blanking, horizontal sync, and vertical sync.

The DP8350 Series CRTC provides for a wide range of programmablility using internal mask programmable ROMs:

- Character Field (both number of dots/character and number of scan lines/character)
- Characters per Row
- Character Rows per Video Frame
- Format of Video Outputs

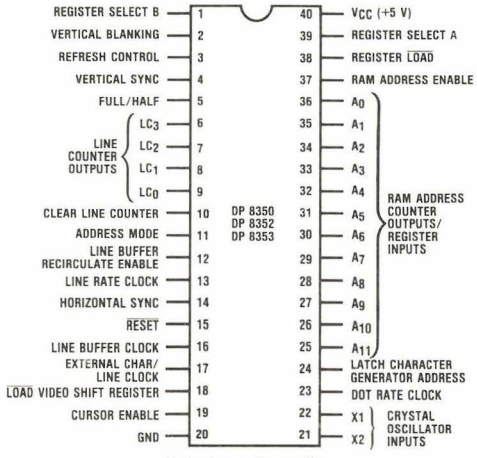
The CRTC also provides system sync and program inputs including Refresh Control, Reset, and Address Mode.

TRI-STATE is a registered trademark of National Semiconductor Corp.

Features

- Internal crystal controlled dot rate oscillator
- External dot rate clock input
- Buffered dot rate clock output
- Timing pulses for character generation
- Character memory address outputs (12 bits)
- Internal cursor address register
- Internal row starting address register
- Internal top-of-page address register (for scrolling)
- Programmable horizontal and vertical sync outputs
- Programmable cursor enable output
- Programmable vertical blanking output
- 2 programmable refresh rates, pin selectable
- Programmable characters/row (128 max.)
- Progammable character field size (up to 16 dots × 16 scan line field size)
- Programmable scan lines/frame (512 max.)
- Programmable character rows/frame
- Single +5V power supply
- Inputs and outputs TTL compatible
- Direct interface with DM86S64 character generator
- Ease of system design/application

Connection Diagram



Ordering Information:

DP8350N
DP8352N
DP8353N

National Semiconductor

June 1981
PRELIMINARY

DS1617/DS3617 Bubble Memory Sense Amplifier

General Description

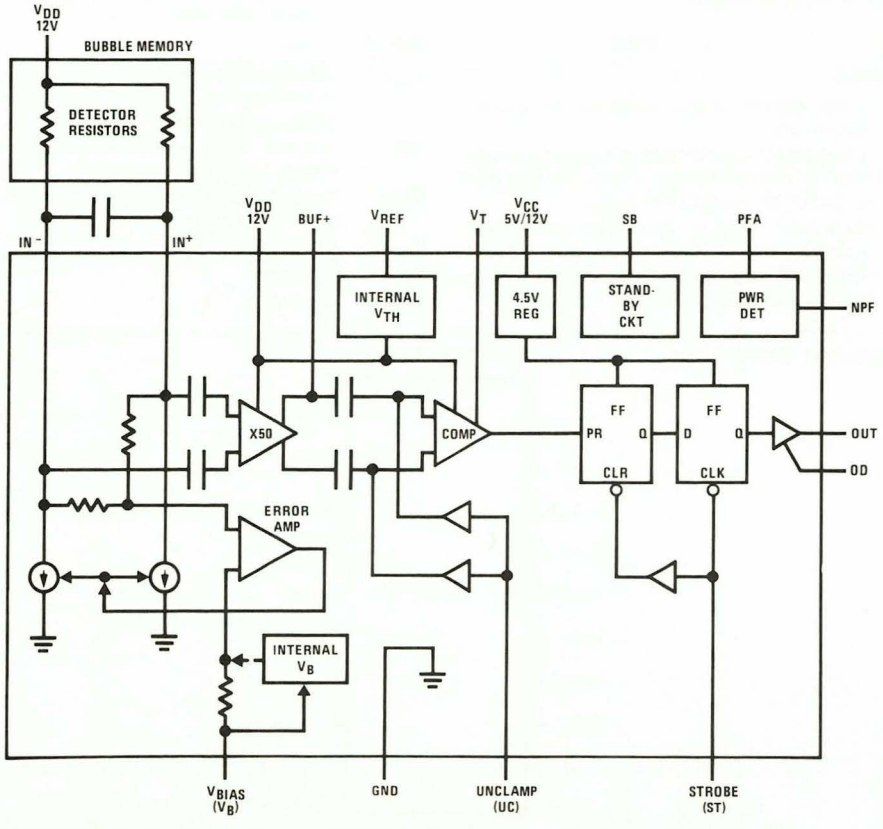
The DS1617/DS3617 are bubble memory sense amplifiers that convert low level signals from magneto-resistive detectors of the bubble memory into TTL compatible output levels. Internal functions consist of an input bias circuit, an internally AC coupled amplifier, a high speed precision comparator, two flip-flops, a TRI-STATE® output stage and a power fail detector.

TTL compatible control inputs allow either average-to-peak or the conventional clamp and strobe (peak-to-peak) sensing of the input signal. The threshold voltage and the input bias voltage are externally adjustable allowing compatibility with different types of bubble memories.

Features

- Single 12V or 12V/5V operation
- On-chip adjustable detector bias circuit
- Choice of average-to-peak or clamp and strobe sensing
- Guaranteed tight threshold limits over the specified temperature and supply voltage range
- Threshold externally adjustable over 0 mV to 20 mV range (typical)
- On-chip reference for a 3 mV (typ) threshold
- TRI-STATE output
- No offset nulling requirement due to on-chip AC coupling at the input
- Power fail detector with adjustable trip level senses—both supplies
- Compatible with a wide range of bubble memories
- Standard 16-pin dual-in-line package

Block Diagram



TRI-STATE® is a registered trademark of National Semiconductor Corp.

Circle DATA UPDATE No. 1188

National Semiconductor

June 1981

PRELIMINARY

DS3615 Bubble Memory Function Driver

General Description

The DS3615 function driver converts digital TTL pulses generated by a timing circuit into the current pulses required by National's NBM2256 256k-bit magnetic bubble memory. The DS3615 consists of input logic gates that are TTL compatible, a D flip-flop, a voltage boost circuit, and six current generators. The current generators deliver constant currents for driving the SWAP gate, generator element, MAP gate, and replicator gate of the magnetic bubble memory.

Features

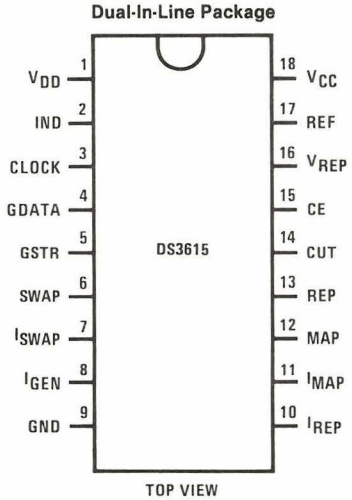
- TTL compatible inputs
- Operates from two standard supplies—5V, 12V
- PNP inputs minimize loading
- Built-in voltage boost circuitry—does not require an extra voltage supply
- Power up/down glitch-free protection for both supplies
- Functionally pin compatible with the DS3618

Pinout Descriptions

Symbol	Description
INPUT LOGIC	
CE	Chip enable input—disables all current generators.
CLOCK	Clock input—clocks GDATA information into D flip-flop with positive edge trigger, and provides clock for voltage boost circuitry.
GSTR	Generator strobe input—strobes GDATA information to GEN current generator.
GDATA	Generator data input—data input to a D flip-flop for GEN current source.
SWAP	SWAP input—data input for SWAP current source.
MAP	MAP transfer input—data input for MAP current source.
REP	Replicator transfer input—data input for REP current source.
CUT	Replicator CUT input—provides CUT input for MAP and REP current sources.
OUTPUT CURRENT SOURCES	
I_{GEN}	Generator current output—provides a current pulse that creates a bubble.
I_{SWAP}	SWAP current output—provides a current pulse that swaps new incoming data with existing data.
I_{MAP}	MAP transfer current output—provides a current pulse that allows replicating of the bubbles in the MAP loop.
I_{REP}	Replicator transfer current output—provides a current pulse that allows replicating of the bubbles in the major loops.
MISC/SUPPLIES	
V_{REP}	Voltage boost output—with required capacitor to ground, provides high voltage output for I_{REP} and I_{SWAP} currents.
IND	Inductor input—inductor to V_{DD} provides voltage boost for V_{REP} output.
REF	Referencing resistor—resistor to ground sets all current sources.
V_{DD}	12V Supply
V_{CC}	5V Supply
GND	Ground

Connection Diagram

Dual-In-Line Package



TOP VIEW

Circle DATA UPDATE No. 1189

NEW DATA UPDATE 4
LITERATURE REQUEST CARD

Please send complete data sheets/applications literature as indicated on the NEW DATA UPDATE numbers I have circled.

Name _____ Title _____

Company _____

Address _____

_____

City _____ State _____ Zip _____

1172 1173 1174 1175 1176 1177 1178 1179 1180 1181 1182 1183 1184 1185 1186
1187 1188 1189 1190 1191 1192 1193 1194 1195 1196 1197 1198 1199 1200 1201
1201 1202 1203 1204 1205 1206 1207 1208 1209 1210 1211 1212 1213 1214 1215
1216 ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Note: Due to costs of handling and mailing we ask that you try to limit your requests to 5 items.

☐ Please add my name to the list for future NEW DATA UPDATES.

NEW DATA UPDATE 4
LITERATURE REQUEST CARD

Please send complete data sheets/applications literature as indicated on the NEW DATA UPDATE numbers I have circled.

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Note: Due to costs of handling and mailing we ask that you try to limit your requests to 5 items.

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National Semiconductor

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National Semiconductor

June 1981
PRELIMINARY

DS3616 Bubble Memory Coil Driver

General Description

The DS3616 bubble memory coil driver provides the function of driving the high current coils of a bubble memory device. The control inputs A, B, $\overline{CS}$ and HLD-EN are TTL compatible to insure easy interfacing to MOS control circuits. Internal logic controls the output sinking and sourcing transistors to drive the X and Y bubble memory coils in a bridged push-pull configuration.

Sourcing transistors are driven into saturation by the on-chip voltage booster for maximum current drive to the coil.

The internal power up/down control circuit prevents glitches and noise on the outputs during system initialization.

$\overline{CS}$ enables the output drive transistors. A pause capability is available from the HLD-EN input to allow asynchronous operation (refer to Typical Applications data).

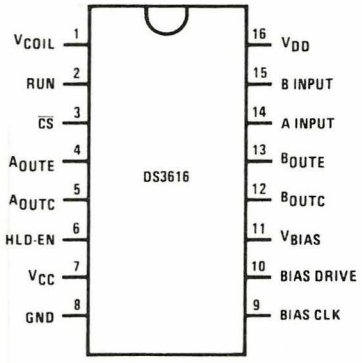
The DS3616 is characterized to operate from 0°C to 70°C.

Features

- Two high current push-pull outputs
- TTL compatible low current inputs
- Two power supplies + 5V and + 12V
- Internal clamp diodes
- Power up/down control circuit
- Optional internal voltage booster
- Run output for function driver control

Connection Diagram

Dual-In-Line Package



TOP VIEW

Circle DATA UPDATE No. 1190

National Semiconductor

June 1981

DS8908 AM/FM Digital Phase-Locked Loop Frequency Synthesizer

General Description

The DS8908 is a PLL synthesizer designed specifically for use in AM/FM radios. It contains the reference oscillator, a phase comparator, a charge pump, an operational amplifier, a 120 MHz ECL/I^2L dual modulus programmable divider, and a 19-bit shift register/latch for serial data entry. The device is designed to operate with a serial data controller generating the necessary division codes for each frequency, and logic state information for radio function inputs/outputs.

A 3.96 MHz pierce oscillator and divider chain generate a 1.98 MHz external controller clock, a 20 kHz, 10 kHz, 9 kHz, and 1 kHz reference signals, and a 50 Hz time-of-day signal. The oscillator and divider chain are sourced by the V_{CCM} pin thus providing a low power controller clock drive and time-of-day indication when the balance of the PLL is powered down.

The 21-bit serial data stream is transferred between the frequency synthesizer and the controller via a 3-wire bus system comprised of a data line, a clock line, and an enable line.

The first 2 bits in the serial data stream address the synthesizer thus permitting other devices such as display drivers to share the same bus. The next 14 bits are used for the PLL (N + 1) divide code. The 15th bit is used internally to select the AM or FM local oscillator input. A high level on this bit enables the FM input and a low level enables the AM input. The 16th and 17th bits are used to select one of the 4 reference frequencies. The 18th and 19th bits are connected via latches to open collector outputs. These outputs can be used to drive radio functions such as gain, mute, AM, FM, or charge pump current source levels.

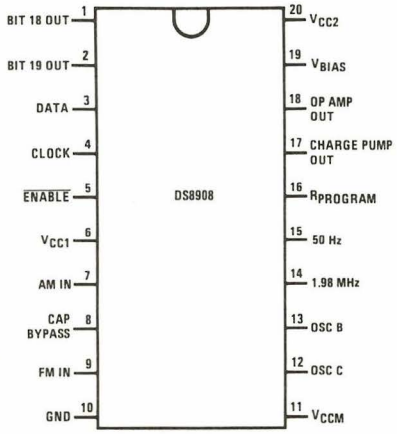
The PLL consists of a 14-bit programmable I^2L divider, an ECL phase comparator, an ECL dual modulus (p/p + 1) prescaler, a high speed charge pump, and an operational amplifier. The programmable divider divides by (N + 1), N being the number loaded into the shift register. The programmable divider is clocked through a ÷7/8 prescaler by the AM input or through a ÷63/64 prescaler by the FM input. The AM input will work at frequencies up to 15 MHz, while the FM input works up to 120 MHz. The VCO can be tuned with a frequency resolution of either 1 kHz, 9 kHz, 10 kHz, or 20 kHz.The buffered AM and FM inputs are self-biased and can be driven directly by the VCO through a capacitor. The ECL phase comparator produces very accurate resolution of the phase difference between the input signal and the reference oscillator. The high speed charge pump consists of a switchable constant current source and sink. The charge pump can be programmed to deliver from 0.1 mA to 1 mA of constant current by connection of an external resistor from pin $R_{PROGRAM}$ to ground or any of the open collector bit outputs. Connection of programming resistors to the bit outputs enables the controller to adjust the loop gain for the particular reference frequency selected. The charge pump will source current if the VCO frequency is high and sink current if the VCO frequency is low. The low noise operational amplifier provided has a high impedance JFET input and a large output voltage range. The op amp's negative input is common with the charge pump output and its positive input is internally biased.

Features

- Uses inexpensive 3.96 MHz reference crystal
- F_{IN} capability greater than 120 MHz allows direct synthesis at FM frequencies
- FM resolution of either 10 kHz or 20 kHz allows usage of 10.7 MHz ceramic filter distribution
- Serial data entry for simplified control
- 50 Hz output for time-of-day reference driven from separate low power V_{CCM}
- 2 open collector buffered outputs for controlling various radio functions
- Separate AM and FM inputs; AM input has 15 mV (typical) hysteresis
- Programmable charge pump current sources enable adjustment of system loop gain
- Operational amplifier provides high impedance load to charge pump output and enables a high voltage output to VCO

Connection Diagram

Dual-In-Line Package



TOP VIEW

National Semiconductor

June 1981

DT1051 DIGITALKER™ Speech Evaluation Kit

General Description

The DIGITALKER™ is a speech synthesis system consisting of several N-channel MOS integrated circuits. It contains a speech processor chip (SPC) and speech ROM and when used with external filter, amplifier, and speaker, produces a system which generates high quality speech including the natural inflection and emphasis of the original speech. Male, female, and children's voices can be synthesized.

The SPC communicates with the speech ROM, which contains the compressed speech data as well as the frequency and amplitude data required for speech output. Up to 128k bits of speech data can be directly accessed.

With the addition of an external resistor, on-chip debounce is provided for use with a switch interface.

An interrupt is generated at the end of each speech sequence so that several sequences or words can be cascaded to form different speech expressions.

The DT1051 is a standard DIGITALKER kit encoded with 18 separate and addressable phrases. The phrases lend themselves to a variety of products, but are primarily for demonstration purposes, portraying DIGITALKER's unique ability to produce high quality male, female, or child's voices.

The DT1051 demonstrates the effects of digitizing complete phrases as opposed to individual words at single addresses. Complete phrases produce very natural and highest quality speech, much like a tape recording of a phrase or sentence.

Features

- COPS™ and MICROBUS™ compatible
- Designed to be easily interfaced to other popular microprocessors
- 18 addressable high quality phrases
- Natural inflection and emphasis of original speech
- Addresses 128k of ROM directly
- TTL compatible
- On-chip switch debounce for interfacing to manual switches independent of a microprocessor
- Interrupt capability for cascading words or phrases
- Crystal controlled or externally driven oscillator

Applications

- Telecommunications
- Appliance
- Automotive
- Teaching aids
- Consumer products
- Clocks
- Language translation
- Annunciators

DT1051 Vocabulary

Byte Address SW8 SW1	Message	Voice
00000000	BASSON MUSIC	N/A
00000001	THIS IS NS DIGITALKER	FEMALE
00000010	THE TIME IS 8:43 PM	FEMALE
00000011	EMERGENCY, CALL 911	FEMALE
00000100	SELECT TEMPERATURE	FEMALE
00000101	SELECT COOKING TIME	FEMALE
00000110	THE NUMBER YOU REACHED HAS BEEN CHANGED, PLEASE CALL 408 737-5000	MALE
00000111	WARNING THE BRAKE FLUID IS LOW	MALE
00001000	PLEASE FASTEN YOUR SEATBELT	MALE
00001001	CHECK OIL LEVEL	MALE
00001010	CHECK COOLANT LEVEL	MALE
00001011	CHECK FUEL LEVEL	MALE
00001100	DOOR OPEN	MALE
00001101	DEFROST	MALE
00001110	GOING UP	MALE
00001111	FIRST FLOOR	MALE
00010000	PLEASE CALL YOUR OFFICE	MALE
00010001	I'M CUTE, AREN'T I?	CHILD
	END OF VOCABULARY	

DIGITALKER™, MICROBUS™ and COPS™ are trademarks of National Semiconductor Corp.

National Semiconductor

June 1981

DT1052 DIGITALKER™ Basic Numbers Kit

General Description

The DIGITALKER™ is a speech synthesis system consisting of several N-channel MOS integrated circuits. It contains a speech processor chip (SPC) and speech ROM and when used with external filter, amplifier, and speaker, produces a system which generates high quality speech including the natural inflection and emphasis of the original speech. Male, female, and children's voices can be synthesized.

The SPC communicates with the speech ROM, which contains the compressed speech data as well as the frequency and amplitude data required for speech output. Up to 128k bits of speech data can be directly accessed.

With the addition of an external resistor, on-chip debounce is provided for use with a switch interface.

An interrupt is generated at the end of each speech sequence so that several sequences or words can be cascaded to form different speech expressions.

The DT1052 is a useful, low cost standard DIGITALKER kit, encoded with the numbers 0 through 9, the word point, and several silence durations, located at individual addresses.

These numerical outputs can be applicable to many consumer and industrial products where numbers are frequently displayed.

Features

- COPS™ and MICROBUS™ compatible
- Designed to be easily interfaced to other popular microprocessors
- 15 addressable expressions, including silences
- Natural inflection and emphasis of original speech
- Addresses 16k of ROM directly
- TTL compatible
- On-chip switch debounce for interfacing to manual switches independent of a microprocessor
- Interrupt capability for cascading words or phrases
- Crystal controlled or externally driven oscillator

Applications

- Telecommunications
- Appliance
- Automotive
- Counters
- Consumer products
- Instrumentation

DT1052 Vocabulary

Byte Address SW8 SW1	Message	Byte Address SW8 SW1	Message
0 0 0 0 0 0 0 0	ZERO	0 0 0 0 1 0 0 0	EIGHT
0 0 0 0 0 0 0 1	ONE	0 0 0 0 1 0 0 1	NINE
0 0 0 0 0 0 1 0	TWO	0 0 0 0 1 0 1 0	POINT
0 0 0 0 0 0 1 1	THREE	0 0 0 0 1 0 1 1	20 ms SILENCE
0 0 0 0 0 1 0 0	FOUR	0 0 0 0 1 1 0 0	40 ms SILENCE
0 0 0 0 0 1 0 1	FIVE	0 0 0 0 1 1 0 1	80 ms SILENCE
0 0 0 0 0 1 1 0	SIX	0 0 0 0 1 1 1 0	160 ms SILENCE
0 0 0 0 0 1 1 1	SEVEN	0 0 0 0 1 1 1 1	320 ms SILENCE

DIGITALKER™, MICROBUS™ and COPS™ are trademarks of National Semiconductor Corp.

National Semiconductor

JUNE 1981

IDM29705/29705A 16-Word by 4-Bit Two-Port RAM/Register File

General Description

The IDM29705 and IDM29705A are 16-word by 4-bit RAM/Register File chips housed in a standard 28-pin dual-in-line package. The IDM29705 and the IDM29705A feature TRI-STATE® outputs. These RAMs, which are fabricated using SCL® (Schottky ECL Technology) feature two separate output ports that enable any two 4-bit words to be read from these outputs simultaneously. Each output port contains a four-bit latch. A common Latch Enable (LE) input is used to control all eight latches. The device, which has two Write Enable (WE) inputs, is designed so that either Write Enable ($WE_{1 \text{ or } 2}$) and Latch Enable (LE) inputs can be wired together to make the operation of the RAM appear edge-triggered.

The device, which has fully decoded A-address and B-address fields, can address any of the 16 memory words for the A-output port and, simultaneously, select any of the 16 words for presentation at the B-output port. Incoming data is written into the four-bit RAM word selected by the B-address. The D inputs are used to load the new data into the device.

Several of these devices can be cascaded to increase the total number of memory words in the system. When $\overline{OE}$-A is high, the A-output port is in the high-impedance mode. $\overline{OE}$-B, when high, forces the B-output port to the high-impedance state.

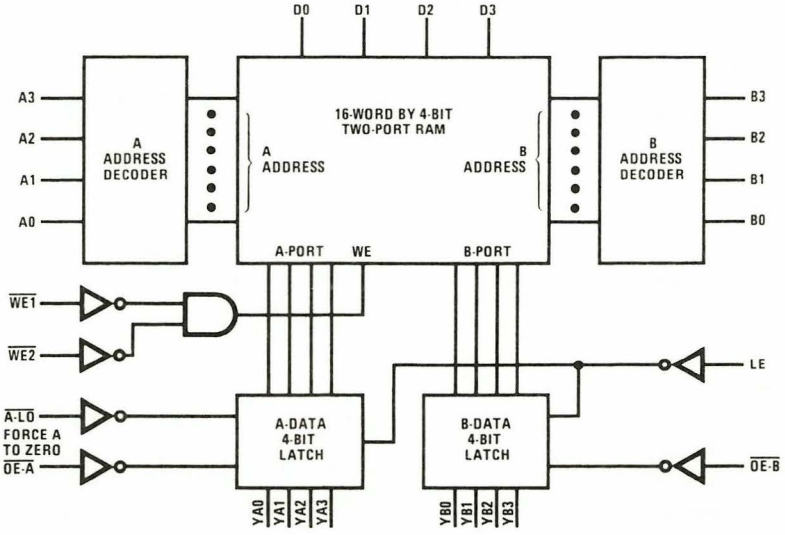
The writing of new data into the RAM is controlled by the Write Enable inputs. With both Write Enable inputs low, data is written into the word selected by the B-address field. The memory outputs follow the data inputs during writing if the Latch Enable (LE) is high. With either Write Enable high, no data is written into the RAM.

Features and Benefits

- 16-Word by 4-Bit, 2-Port RAM/Register Files
- Two Output Ports, Each with Separate Output Control
- 4-Bit Latches on Each Output Port
- Non-Inverted Data Output with Respect to Data Input
- Output Enable and Write Enable Inputs Provide Ease in Cascading
- SCL Technology (Schottky ECL) Provides ECL Speeds While Keeping Low Power Schottky Input/Output Voltage and Power Consumption Compatibility
- 100% Reliability Testing in Compliance with MIL-STD-883

TRI-STATE and SCL are registered trademarks of National Semiconductor Corp.

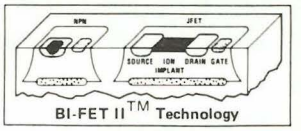
IDM29705/29705A Block Diagram



Circle DATA UPDATE No. 1194

National Semiconductor

June 1981



LF442A/LF442 Dual Low Power JFET Input Operational Amplifier

PRELIMINARY

General Description

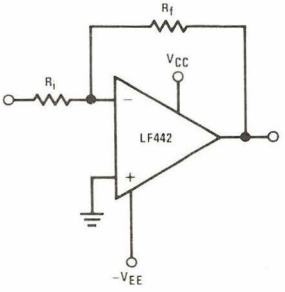
The LF442 dual low power operational amplifiers provide many of the same AC characteristics as the industry standard LM1458 while greatly improving the DC characteristics of the LM1458. The amplifiers have the same bandwidth, slew rate, and gain (10 kΩ load) as the LM1458 and only draw one tenth the supply current of the LM1458. In addition the well matched high voltage JFET input devices of the LF442 reduce the input bias and offset currents by a factor of 10,000 over the LM1458. A combination of careful layout design and internal trimming guarantees very low input offset voltage and voltage drift. The LF442 also has a very low equivalent input noise voltage for a low power amplifier.

The LF442 is pin compatible with the LM1458 allowing an immediate 10 times reduction in power drain in many applications. The LF442 should be used anywhere low power dissipation and good electrical characteristics are the major considerations.

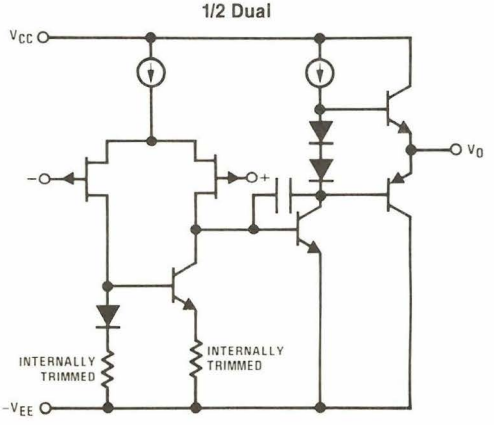
Features

■ 1/10 supply current of a LM1458	400 μA (max)
■ Low input bias current	50 pA (max)
■ Low input offset voltage	1 mV (max)
■ Low input offset voltage drift	10 μV/°C (max)
■ High gain bandwidth	1 MHz
■ High slew rate	1 V/μs
■ Low noise voltage for low power	40nV/√Hz
■ Low input noise current	0.01 pA/√Hz
■ High input impedance	$10^{12}\Omega$
■ High gain $V_O = \pm 10V$, $R_L = 10k$	50k (min)

Typical Connection

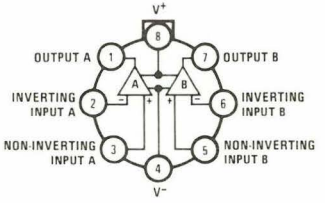


Simplified Schematic



Connection Diagrams

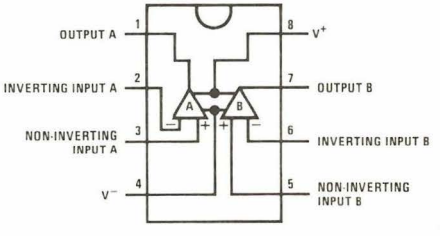
LF442AMH, LF442ACH, LF442CH
Metal Can Package



TOP VIEW

Note. Pin 4 connected to case.

LF442ACN, LF442CN
Dual-In-Line Package



TOP VIEW

BI-FET II™ is a trademark of National Semiconductor Corp.

National Semiconductor

PRELIMINARY

DNR™ DYNAMIC NOISE REDUCTION SYSTEM

May 1981

LM1894 Dynamic Noise Reduction System DNR™

General Description

The LM1894 is a stereo noise reduction circuit for use with audio playback systems. The DNR™ system is non-complementary, meaning it does not require encoded source material. The system is compatible with virtually all prerecorded tapes and FM broadcasts. Psychoacoustic masking, and an adaptive bandwidth scheme allow the DNR™ to achieve 10 dB of noise reduction. DNR™ can save circuit board space and cost because of the few additional components required.

Features

- Non-complementary noise reduction, "single ended"
- Low cost external components, no critical matching
- Compatible with all prerecorded tapes and FM
- 10 dB effective tape noise reduction CCIR/ARM weighted
- Wide supply range, 4.5V to 18V
- 1 Vrms input overload
- No license requirements

Applications

- Automotive radio/tape players
- Compact portable tape players
- Quality HI-FI tape systems
- VCR playback noise reduction
- Video disc playback noise reduction

Typical Application

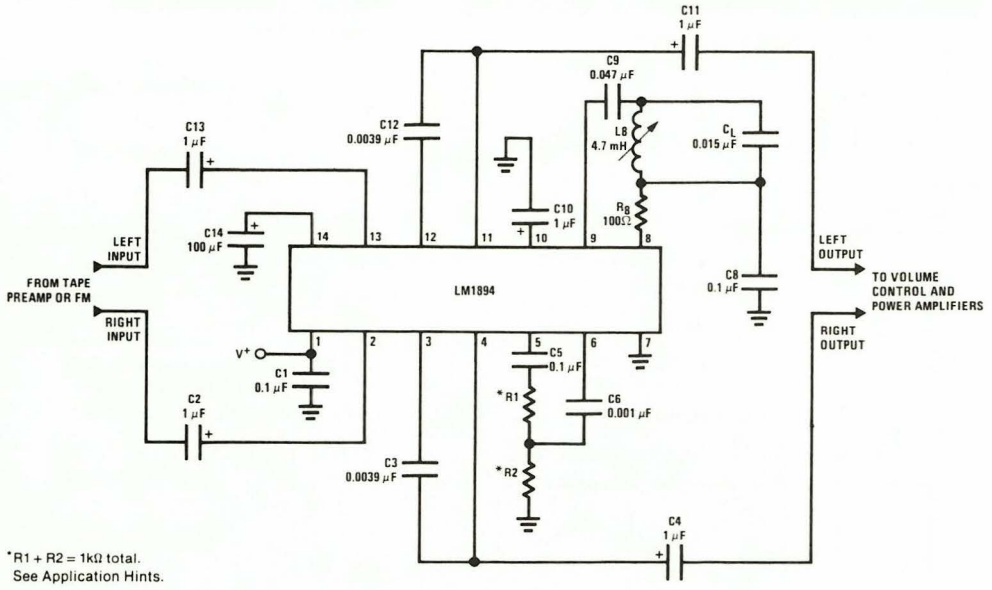


FIGURE 1. Component Hook-Up for Stereo DNR™ System

DNR™ is a trademark of National Semiconductor Corp.
The DNR™ system is licensed to National Semiconductor Corp. under U.S. patent 3,678,416 and 3,753,159.
Contact National Semiconductor for use of DNR™ logo.

National Semiconductor

May 1981

LM13600/LM13600A/LM11600A Dual Operational Transconductance Amplifiers With Linearizing Diodes and Buffers

General Description

The LM13600 series consists of two current controlled transconductance amplifiers each with differential inputs and a push pull output. The two amplifiers share common supplies but otherwise operate independently. Linearizing diodes are provided at the inputs to reduce distortion and allow higher input levels. The results is a 10 dB signal-to-noise improvement referenced to 0.5 percent THD. Controlled impedance buffers are provided which are especially designed to complement the dynamic range of the amplifiers.

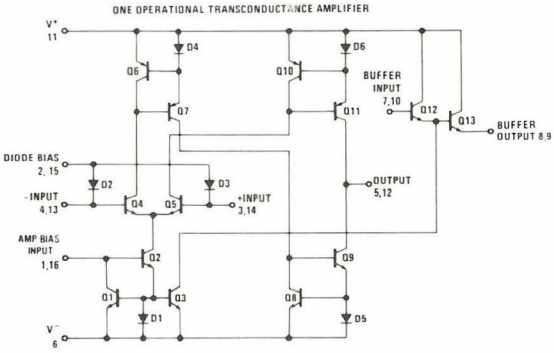
Features

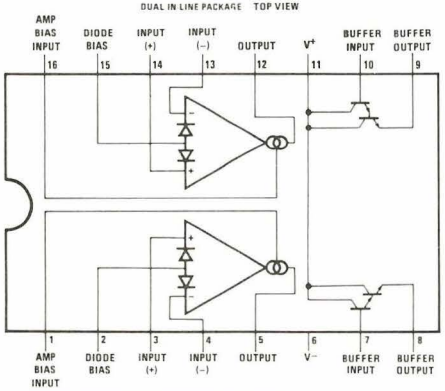
- gm adjustable over 6 decades
- Excellent gm linearity
- Excellent matching between amplifiers
- Linearizing diodes
- Controlled impedance buffers
- High output signal to noise ratio
- Wide supply range ± 2V to ± 22V.

Applications

- Current controlled amplifiers
- Current controlled impedances
- Current controlled filters
- Current controlled oscillators
- Multiplexers
- Timers
- Sample and hold circuits

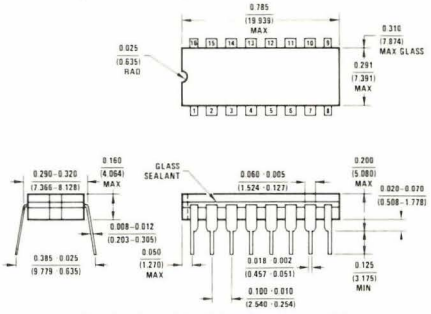
Schematic and Connection Diagrams



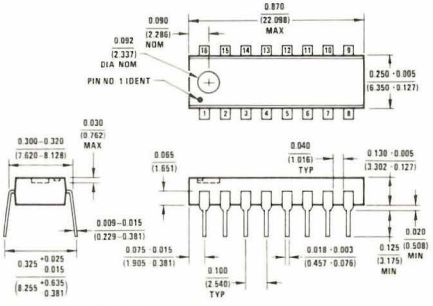


Physical Dimensions

incnes (millimeters)



Cavity Dual-In-Line Package (J)
Order Number LM11600AJ
NS Package Number J16A



Molded Dual-In-Line Package (N)
Order Number LM13600N or LM13600AN
NS Package Number N16A

Circle DATA UPDATE No. 1197

National Semiconductor

May 1981

LM13700/LM13700A/LM11700A Dual Operational Transconductance Amplifiers With Linearizing Diodes and Buffers

General Description

The LM13700 series consists of two current controlled transconductance amplifiers each with differential inputs and a push pull output. The two amplifiers share common supplies but otherwise operate independently. Linearizing diodes are provided at the inputs to reduce distortion and allow higher input levels. The results is a 10 dB signal-to-noise improvement referenced to 0.5 percent THD. High impedance buffers are provided which are especially designed to complement the dynamic range of the amplifiers.

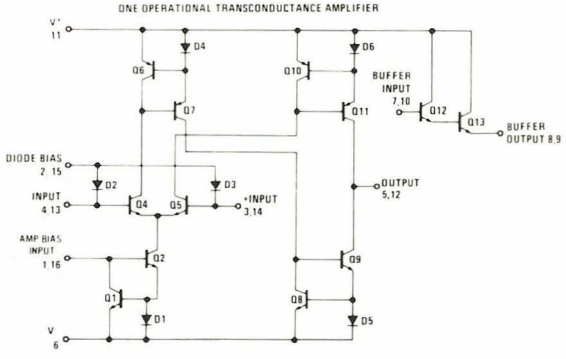
Features

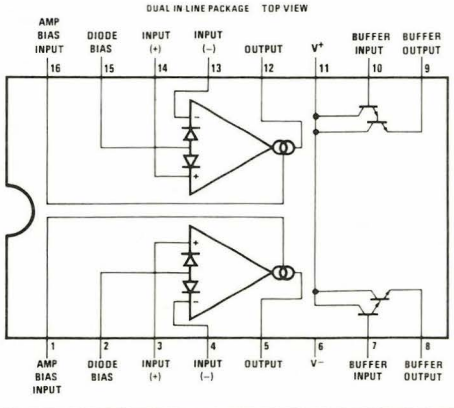
- gm adjustable over 6 decades
- Excellent gm linearity
- Excellent matching between amplifiers
- Linearizing diodes
- High impedance buffers
- High output signal to noise ratio
- Wide supply range ± 2V to ± 22V.

Applications

- Current controlled amplifiers
- Current controlled impedances
- Current controlled filters
- Current controlled oscillators
- Multiplexers
- Timers
- Sample and hold circuits

Schematic and Connection Diagrams



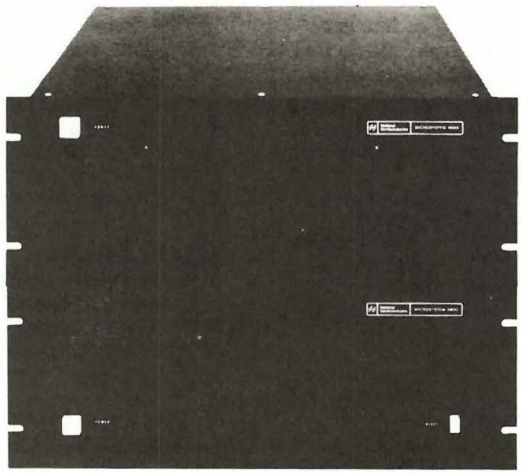


Circle DATA UPDATE No. 1198

National Semiconductor

May 1981

Microsystem 6600 General Purpose Industrial Microcomputer System



- **CP/M® Operating System**
- **Multibus™**

— Industry Standards —

- **Popular Software Interface**
- **Fast, Dynamic File Allocation**
- **Includes Programming Utilities — editor, assembler, debugger**
- **Extensive Software Available**
- **Comprehensive Diagnostics**
- **Quality Service and Training**
- **Industrial Quality Bus — multiple masters**
- **19″ Rack Mounting**
- **Expandable via Quality BLC/SBC Series/80 Boards — for a wide range of applications**
- **Printer & CRT Interfaces**
- **1 or 5 slot Expansion Capability**

Product Overview

The Microsystem 6600 is an adaptable, configurable rackmount microcomputer system. This general purpose system is based on the two most popular and durable hardware and software standards in the industry, providing an interface to an extensive selection of software and Series/80 board level products. The system offers a fast and high-quality solution to a wide range of industrial and commercial applications.

Configured from high technology designs, field-proven in the most demanding systems environments and backed by National Semiconductor's experienced service and training organizations, the Microsystem 6600 family is a dependable and well-supported product line.

CP/M is a registered trademark of Digital Research Corp.
Multibus is a trademark of Intel Corp.

Circle DATA UPDATE No. 1199

National Semiconductor

APRIL 1981

MM5452, MM5453 Liquid Crystal Display Drivers

General Description

The MM5452 is a monolithic integrated circuit utilizing CMOS metal gate, low threshold enhancement mode devices. It is available in a 40-pin molded package. The chip can drive up to 32 segments of LCD and can be paralleled to increase this number. The chip is capable of driving a 4 1/2-digit 7-segment display with minimal interface between the display and the data source.

The MM5452 stores the display data in latches after it is clocked in, and holds the data until new display data is received.

Features

- Serial data input
- No load signal required
- $\overline{\text{DATA ENABLE}}$ (MM5452)
- Wide power supply operation
- TTL compatibility
- 32 or 33 outputs
- Alphanumeric and bar graph capability
- Cascaded operation capability

Applications

- COPs or microprocessor displays
- Industrial control indicator
- Digital clock, thermometer, counter, voltmeter
- Instrumentation readouts
- Remote displays

Block and Connection Diagrams

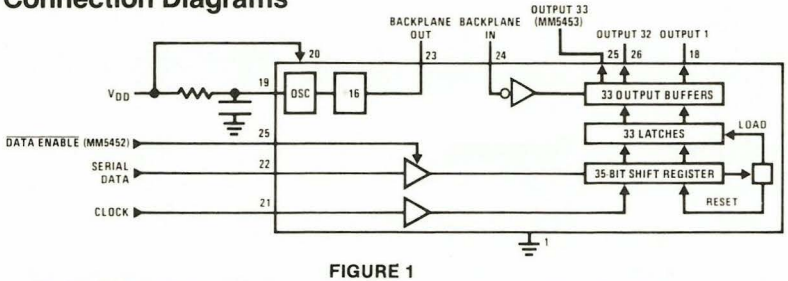


FIGURE 1

Dual-In-Line Package

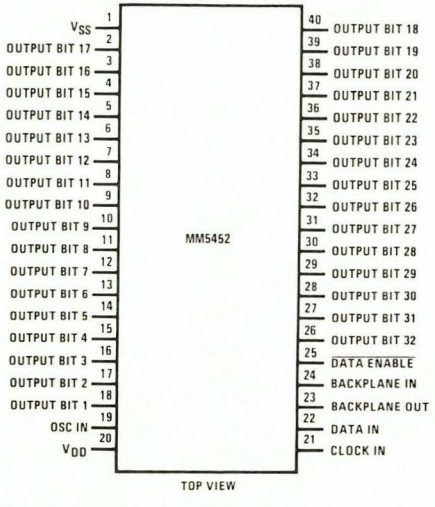


FIGURE 2a

Dual-In-Line Package

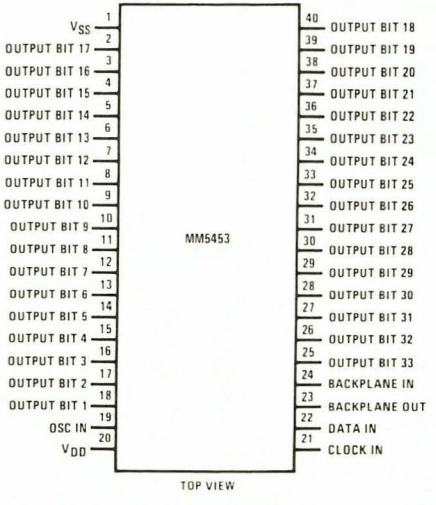


FIGURE 2b

Circle DATA UPDATE No. 1200

National Semiconductor

April 1981

MM52116 (2316E) 16,384-Bit MAXI-ROM®

General Description

The MM52116 is a static MOS 16,384-bit read-only memory organized in a 2048-word-by-8-bit format. It is fabricated using N-channel enhancement and depletion-mode technology which provides complete DTL/TTL compatibility and single power-supply operation.

Three programmable chip selects controlling the TRI-STATE® outputs allow for memory expansion.

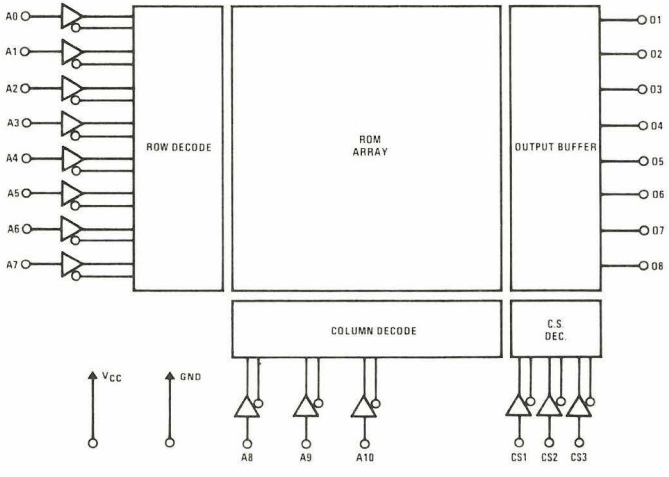
Features

- Fully decoded
- Single 5V power supply ±10% tolerance
- Inputs and outputs TTL compatible
- Outputs drive 2 TTL loads and 100 pF
- Static operation
- TRI-STATE outputs for bus interface
- Programmable chip selects
- 2048-word-by-8-bit organization
- Maximum access time — 450 ns
- Industry standard pin outs (2316E)
- Compatible with standard EPROMs

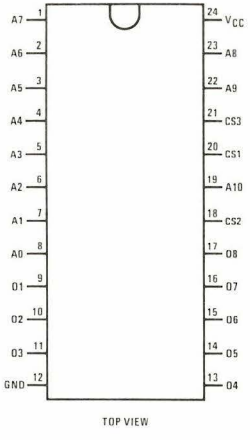
Applications

- Microprocessor instruction store
- Control logic
- Table look-up

Block and Connection Diagrams



Dual-In-Line Package



TOP VIEW

MAXI-ROM® is a registered trademark of National Semiconductor Corp.

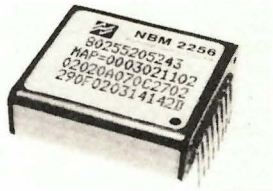
TRI-STATE® is a registered trademark of National Semiconductor Corp.

Circle DATA UPDATE No. 1201

April 1981

National Semiconductor

NBM2256 256k x 1
Magnetic Bubble Memory Device



General Description

The NBM2256 is a 262,144 (2^{18}) bit magnetic bubble memory device. All required magnetic components, including the drive field coils, permanent magnets and protective magnetic shield are integral parts of the device. It is packaged in a 1.3 x 1.1 x 0.36 inch 16-pin DIP.

The NBM2256 features a dual block-replicate organization with true swap gates on the input track. The storage area is arranged as 256 storage loops of 1024 bit locations each. Additional loops are provided for error correction code and defect tolerance. A map of redundant loop data is provided on-chip in one of two dedicated map loops.

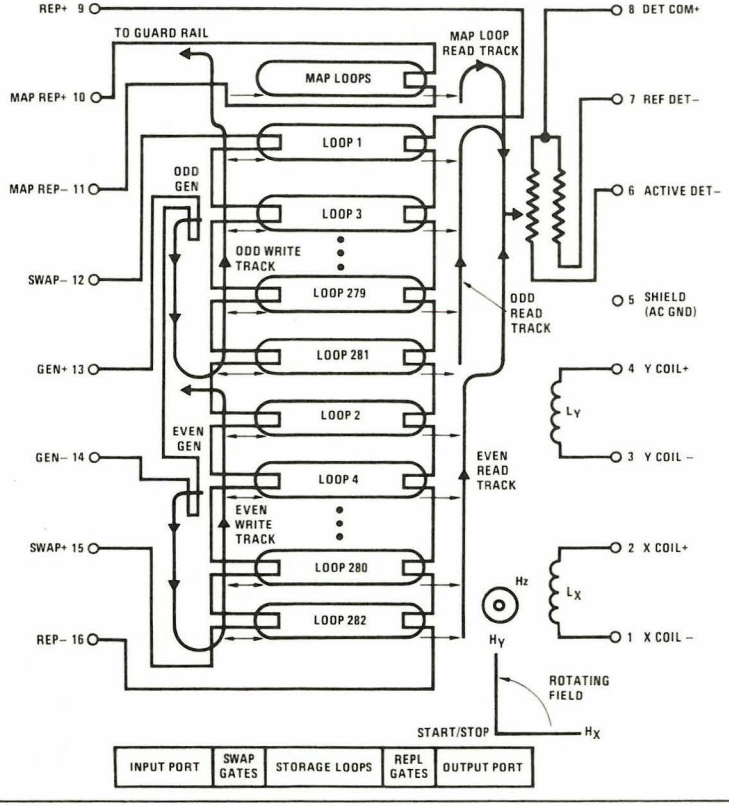
The NBM2256 bubble memory can be operated synchronously or asynchronously. Average access time for a page of data is less than 7 ms at 100 kHz. Average power dissipation at 100 kHz is 0.7W. Device performance is guaranteed over a case temperature range of 0°C to 70°C and data is retained without power from −40°C to 100°C.

The device is fabricated using a pseudo-planar process to improve operating margins as well as to enhance reliability. The use of CrCuCr in the conductor elements insures excellent conductivity while greatly enhancing resistance to failure from electromigration.

Features

- Solid state
- Non-volatile
- High density
- Low power
- Page-oriented access
- Start/stop capability
- Modular capacity
- On-chip error map
- Single sense channel required
- Swap gate
- Error correction code storage

Chip Organization



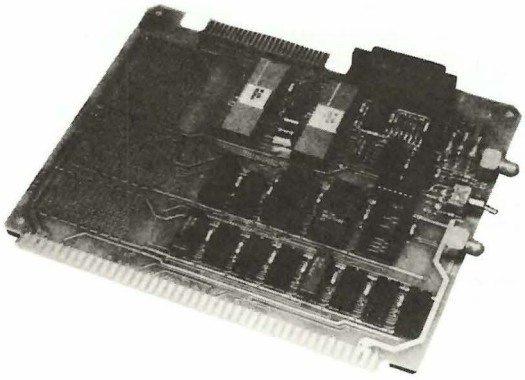
Circle DATA UPDATE No. 1202

National Semiconductor

Preliminary
May 1981

NSC888

NSC800 Evaluation Board



Features

- NSC800 8-Bit P²CMOS™ CPU
- Executes Z80™ Instruction Set
- 20 Programmable Parallel I/O Lines
- Two 16-Bit Programmable Counters/Timers
- Powerful 2K x 8 Monitor Program
- Five Levels of Vectored Prioritized Interrupts
- RS232 Interface
- 1K x 8 P²CMOS RAM with Sockets for Up to 4K x 8 RAM
- Socket for additional 2K x 8, 2716 Compatible Memory Component
- Wire Wrap Area
- Edge Connectors for System Expansion
- Single-Step Operation Mode
- Fully Assembled and Tested

Product Overview

The NSC888 is a self-contained microprocessor board which enables the user to quickly evaluate the performance and features of the NSC800 product family. This fully assembled, tested board requires only the addition of a ±5V supply and an RS232 interface cable to the users terminal to begin NSC800 evaluation.

A powerful system monitor is provided on the board which controls serial communications via the RS232 port. The monitor also includes command functions to load, execute and debug NSC800 programs.

The board includes an NSC800 CPU plus RAM, EPROM, I/O, Timers and interface components yet draws only 30mA from the +5V supply and 3mA from the -5V supply.

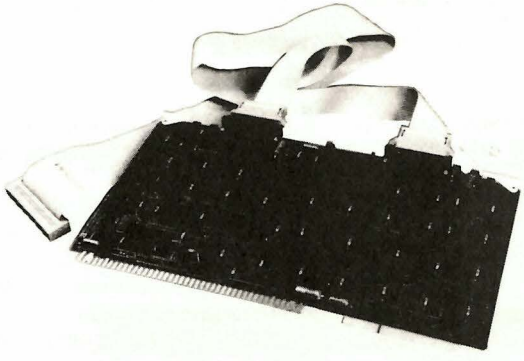
Although designed primarily as an assessment vehicle, the NSC888 can be readily programmed and adapted to a variety of uses. Wire wrap area is provided on-board for the user to build up additional circuitry or interfaces, thus tailoring this high-performance, low-power microprocessor board to meet individual needs.

P²CMOS is a trademark of National Semiconductor Corp.

Z80 is a trademark of Zilog Corp.

Circle DATA UPDATE No. 1203

SPM-A15
COPS™ In-System Emulator Package



- **True Real-Time Emulation of the COP400 Family of Microcontrollers**
- **Plugs Directly into Any Configuration STARPLEX™ or STARPLEX II™ Development System**
- **Includes ISE™ Target Board, STARPLEX & STARPLEX II Emulator Cable, Cross Assembler, Complete Software and User's Manuals**
- **Easy to Use**
  - Hardware
    - Real-time trace of 256 × 20-bit instruction cycles
    - 4K × 8-bit of Shared RAM Memory for rapid downloading of programs from STARPLEX/STARPLEX II peripherals
    - 1K × 12-bit dump memory used in place of control firmware
    - External hardware breakpoint
    - Breakpoint timer in milliseconds
    - Fully compatible with a STARPLEX/ STARPLEX II system bus
    - One target card handles entire series of microcontrollers
  - Software
    - Software breakpoints
    - Lists user-specified registers when selected breakpoint is detected
    - Mnemonic modification of object code
    - Step-list-restart command
    - Dump routines for various COPS microcontroller chips
- **Compatible Software Available to Control the COPS-T01-QUIKLOOK™ Incoming Component Tester**
- **Software to Create a Disk File for Transmission of Customer ROM Patterns and Device I/O Options**

Product Overview

The COP400 In-System Emulator (ISE) is designed for users with the STARPLEX/STARPLEX II Development System. Coupled with the power of STARPLEX/ STARPLEX II, COP400 ISE is a very powerful tool available for developing and debugging COP400 family based microcontroller products. The COP400 ISE target board, which is fully compatible with the STARPLEX/STARPLEX II system bus, plugs directly into any configuration STARPLEX/STARPLEX II Development System and interfaces easily with any COP400 system through a flat cable via an external emulator board terminating in a COP400 pin-compatible plug — e.g., 20, 24 or 28 pin pin-compatible plugs, depending on the microcontroller chip. With this plug replacing the COP400 microcontroller device in the target system, the designer has the capability of executing the target system program in real-time while collecting up to 256 instruction cycles of true real-time trace data. In addition, he can single step through his program and display the data from a 4K Shared Memory location.

COP, ISE, Starplex, Starplex II, Quiklook are trademarks of National Semiconductor Corp.

National Semiconductor

May 1981

PRELIMINARY

TP3020/TP3021 Monolithic CODECs

General Description

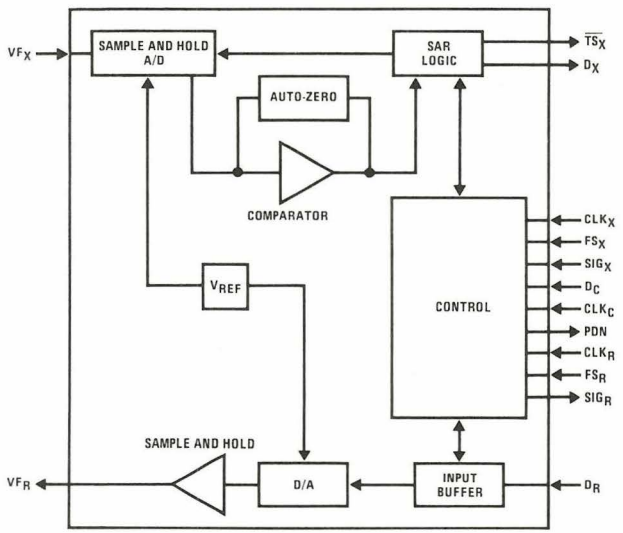
The TP3020 and TP3021 are monolithic PCM CODECs implemented with double-poly CMOS technology. The TP3020 is intended for μ-law applications and contains logic for μ-law signaling insertion and extraction. The TP3021 is intended for A-law applications.

Each device contains separate D/A and A/D circuitry, all necessary sample and hold capacitors, a precision voltage reference and internal auto-zero circuit. A serial control port allows an external controller to individually assign the PCM input and output ports to one of up to 32 time slots or to place the CODEC into a power-down mode. Alternately, the TP3020/TP3021 may be operated in a fixed time slot mode. Both devices are intended to be used with the TP3040 monolithic PCM filter which provides the input anti-aliasing function for the encoder and smoothes the output of the decoder and corrects for the sin x/x distortion introduced by the decoder sample and hold output.

Features

- Low operation power—50 mW typical
- Low standby power—1 mW typical
- ±5V operation
- TTL compatible digital interface
- Time slot assignment or alternate fixed time slot modes
- Internal precision reference
- Internal sample and hold capacitors
- Internal auto-zero circuit
- TP3020—μ-law coding with signaling capabilities
- TP3021—A-law coding
- Synchronous or asynchronous operation

Simplified Block Diagram



National Semiconductor

May 1981

TP3040/TP3040A PCM Monolithic Filter

General Description

The TP3040/TP3040A filter is a monolithic circuit containing both transmit and receive filters specifically designed for PCM CODEC filtering applications in 8 kHz sampled systems.

The filter is manufactured using double-poly silicon gate CMOS technology. Switched capacitor integrators are used to simulate classical LC ladder filters which exhibit low component sensitivity.

TRANSMIT FILTER STAGE

The transmit filter is a fifth order elliptic low pass filter in series with a fourth order Chebyshev high pass filter. It provides a flat response in the passband and rejection of signals below 200 Hz and above 3.4 kHz.

RECEIVE FILTER STAGE

The receive filter is a fifth order elliptic low pass filter designed to reconstruct the voice signal from the decoded/demultiplexed signal which, as a result of the sampling process, is a stair-step signal having the inherent sin x/x frequency response. The receive filter approximates the function required to compensate for the degraded frequency response and restore the flat passband response.

Features

- Exceeds all D3/D4 and CCITT specifications
- +5V, −5V power supplies
- Low power consumption:
  45 mW (600Ω 0 dBm load)
  30 mW (power amps disabled)
- Power down mode: 0.5 mW
- 20 dB gain adjust range
- No external anti-aliasing components
- Sin x/x correction in receive filter
- 50/60 Hz rejection in transmit filter
- TTL and CMOS compatible logic
- All inputs protected against static discharge due to handling

Block and Connection Diagrams

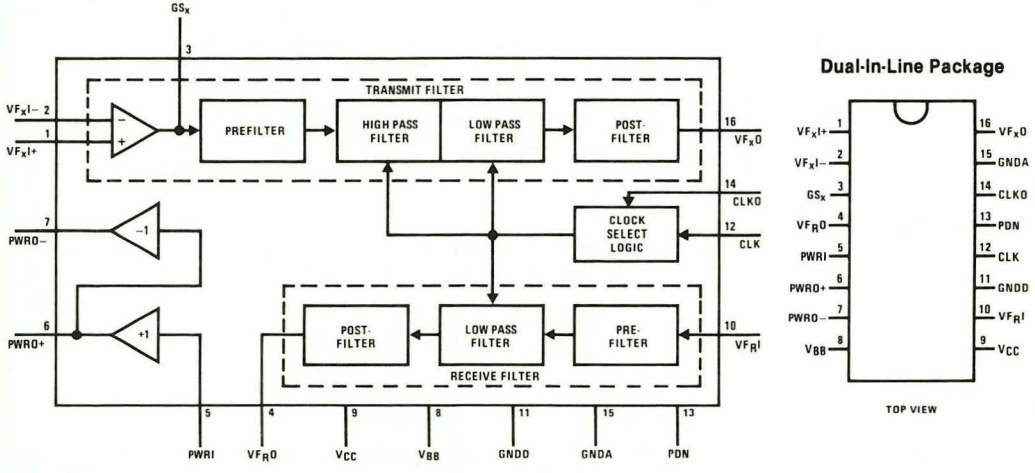


FIGURE 1

National Semiconductor

May 1981
PRELIMINARY

TP5116/TP5116A, TP5156/TP5156A Monolithic CODECs

General Description

The TP5116/TP5116A and TP5156/TP5156A are monolithic PCM CODECs implemented with double-poly CMOS technology. The TP5116 and TP5116A are intended for μ-law applications. The TP5156 and TP5156A are intended for A-law applications.

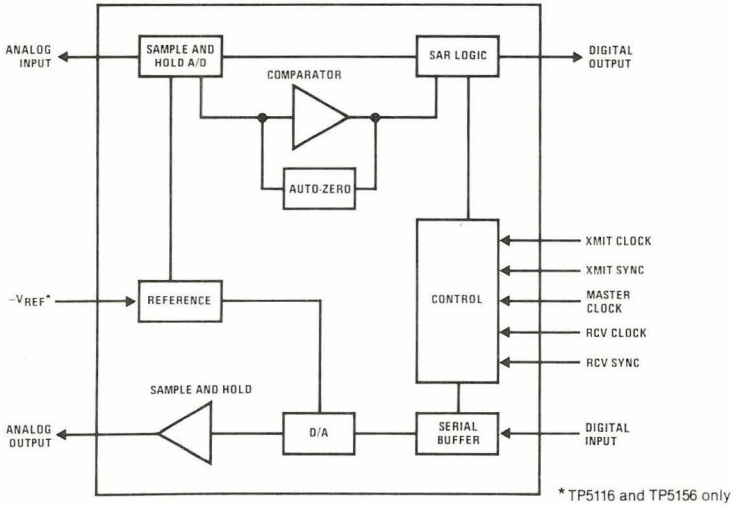
Each device contains separate D/A and A/D circuitry, all necessary sample and hold capacitors, and internal auto-zero circuits. The TP5116A and TP5156A also include a precision voltage reference.

All devices are intended to be used with the TP3040 monolithic PCM filter which provides the input anti-aliasing function for the encoder and smooths the output of the decoder and corrects for the sin x/x distortion introduced by the decoder sample and hold output.

Features

- Low operation power — 50 mW typical
- Low standby power — 1 mW typical
- ±5V operation
- TTL compatible digital interface
- Internal precision reference on TP5116A and TP5156A
- Internal sample and hold capacitors
- Internal auto-zero circuit
- TP5116/TP5116A — μ-law coding (sign plus magnitude format)
- TP5156/TP5156A — A-law coding
- Synchronous or asynchronous operation

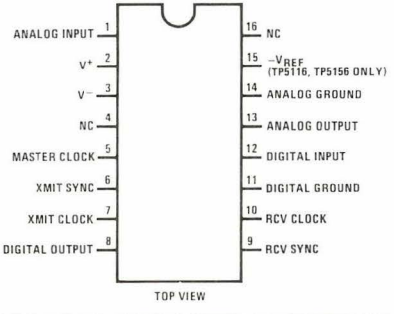
Simplified Block Diagram



*TP5116 and TP5156 only

Connection Diagram

Dual-In-Line Package



TOP VIEW

Circle DATA UPDATE No. 1207

THE DATA BOOKSHELF: TOOLS FOR THE DESIGN ENGINEER

National Semiconductor's Data Bookshelf is a compendium of information about a product line unmatched in its breadth in the industry. The seventeen independent volumes that comprise the Bookshelf—about 8000 pages—describe in excess of 8100 solid-state devices; devices that span the entire spectrum of semiconductor processes, and that range from the simplest of discrete transistors to microprocessors—those most-sophisticated marvels of modern integrated-circuit technology.

Active and passive devices and circuits; hybrid and monolithic structures; discrete and integrated components... complete electrical and mechanical specifications; charts, graphs, and tables; test circuits and waveforms; design and application information... whatever you need, you'll find it in the designer's ultimate reference source—National Semiconductor's Data Bookshelf.

AUDIO/RADIO HANDBOOK

This 240 page handbook acquaints those involved in audio systems design with National Semiconductor's broad selection of integrated circuits specifically designed for accurate audio reproduction.

Far from just a collection of data sheets, this manual contains detailed discussions, including complete design particulars, covering many areas of audio.

Thorough explanations, complete with real-world design examples make clear several audio areas never before available to the general public.

Page Count: 240 Price: $5.00 Year: 1980

CMOS DATABOOK

This databook contains information on National Semiconductor's standard SSI/MSI CMOS products. This includes the popular 54C/74C series logic family, which is pin for pin, function for function equivalent to the 7400 family of TTL devices. All device outputs are LPTTL compatible, capable of sinking more than 360 μA ($\approx$1 LSTTL load). The AC parameters are specified with a 50 pF capacitive load.

In addition, this book describes National Semiconductor's extensive line of CD40XXB and CD45XXB series devices. These parts meet the standard JEDEC "B-Series" specifications.

Special Function, LSI, A/D Converters and Memory device specifications contained herein offer the designer unique high density low power system solutions. All devices are compatible with 54C/74C series and CD4XXB series products.

Page Count: 842 Price: $6.00 Year: 1981

DATA CONVERSION/ACQUISITION DATABOOK

National Semiconductor provides 864 pages of in-depth component and application data about devices in the direct analog signal path before (and after) the digital processor.

With high volume production capabilities, National Semiconductor has become a leader in data conversion/acquisition by utilizing state of the art processes like BI-FET™, linear bipolar, CMOS, thin film, laser trimming, I^2L, and hybrid.

Selection guides for analog switches/multiplexers, A/D and D/A converters, sample and hold, and voltage reference, and a data conversion/acquisition circuits cross reference guide, along with an alphanumeric index, facilitate quick and easy information selection.

Page Count: 864 Price: $7.00 Year: 1980

THE DISCRETE DATABOOK*

480 pages about National Semiconductor's growing line of transistor and FET products are thoroughly cross-referenced and indexed in the Discrete Databook.

Data has been arranged so part numbers can be determined when only process type, industry equivalent, performance requirements, or physical dimensions are known.

Sections include NPN and PNP transistors, the Pro-Electron series, the JEIDA series, and the NA/NB/NR series, plus process characteristics data sheets.

Glossaries of transistor and JFET symbols, and package outlines are in the appendices.

Page Count: 480 Price: $5.00 Year: 1978

* Not available at this time, please consult local sales representative.

48-SERIES MICROCOMPUTER HANDBOOK

This handbook contains detailed design-related information pertaining to the National Semiconductor 48-series single-chip microcomputers and microprocessors.

The material presented is at a level of detail to aid in the design and development of systems using the 48-series microcomputers.

Topics include the 48-series architecture, expansion, and instruction set.

Additional hardware examples, integrated with the required software, and various data sheets of compatible devices are given.

Page Count: 192 Price: $5.00 Year: 1980

THE IDM2900 MICROPROCESSOR DATABOOK

This 208 page databook covers the full spectrum of the National Semiconductor 2900 family of bipolar microprocessors, comprised of 2900 LSI, memory, and logic components.

The data sheets included consider the architecture, characteristics, and operation of bipolar LSI components.

The IDM2900 product line has added new bit-slices and microsequencers designed with the SCL technique — combining the performance of ECL with low power Schottky I/O compatibility.

National Semiconductor, as ever concerned with optimal system performance, provides useful application notes about bit-slice microprocessor design.

Page Count: 208 Price: $3.00 Year: 1980

THE INTERFACE DATABOOK

In National Semiconductor's Interface Databook, 702 pages of specifications describe one of the industry's broadest lines of interface products.

Over 300 data sheets have been compiled, covering transmission line drivers/receivers, bus transceivers, peripheral/power drivers, level translators/buffers, display drivers, MOS and magnetic memory interface circuits, microprocessor support circuits, applicable TTL and CMOS logic circuits.

An industry cross reference guide gives National Semiconductor's exact replacement for 7 other manufacturers. Product selection guides and a complete product applications section make it easy to find the correct part number for these specialized ICs.

Page Count: 702 Price: $6.00 Year: 1980

LINEAR DATABOOK

The 1980 Linear Databook provides over 1,300 pages of up-to-date information about National's broad line of linear components.

Selection guides, term definitions, features, and diagrams are included for voltage and precision regulators, op amps and instrumentation amplifiers, analog switches/multiplexers, sample and hold, A/D and D/A converters, audio, radio and TV circuits, and transistor/diode arrays.

A usage breakdown is given for components in various industrial, automotive, appliance, functional blocks and telecommunications applications.

Appendices include extended quality and reliability programs, MIL-STD-883/MIL-M-38510 information, and linear and industry cross reference guides.

Page Count: 1376 Price: $9.00 Year: 1980

LINEAR APPLICATIONS HANDBOOK

This 712 page handbook provides a fully indexed and cross referenced collection of 110 linear circuit applications using both monolithic and hybrid circuits from National Semiconductor's broad line of linear products.

Thought provoking applications, written by National's engineers, are an excellent reference source for linear design problems.

Consumer applications; frequency, temperature and drift compensation; and improving signal to noise ratios are just a few of the design requirements considered.

Page Count: 712 Price: $16.00 Year: 1980

LOGIC DATABOOK

National's new Logic Databook covers five of their logic families: TTL (54/74), Schottky (54S/74S), low power Schottky (54LS/74LS), high speed (54H/74H), and low power (54L/74L).

The Logic Databook—specially organized for quick and easy referencing—offers two complete functional indices and selection guides, one for SSI and one for MSI devices. In addition, it includes over 100 connection diagrams and test waveforms to help speed the design-in cycle.

All in all, it's probably the most comprehensive collection of practical information ever assembled on such a broad line of practical components.

Page Count: 624 Price: $9.00 Year: 1981

MEMORY DATABOOK*

National Semiconductor has continued its reputation as a high volume supplier of high quality, cost-effective components by expanding into the design and processing of semiconductor memories.

While developing this state-of-the-art technology, National met the problems of industry standardization by proposing and utilizing new terminology and symbols to make all memory data sheets consistent. Hence, a cohesive, 464 page databook that includes selection guides, diagrams, and test characteristics for RAMs, EPROMs, MOS ROMs, and magnetic bubble memories.

Sections have also been devoted to character generators, memory support circuits, and physical dimensions.

Page Count: 464 Price: $6.00 Year: 1980

* Not available at this time, please consult local sales representative.

MEMORY APPLICATIONS HANDBOOK

More than 200 pages are devoted to in-depth Memory Applications material, including design aids, application notes, technical descriptions and background information for RAMs, ROMs, PROMs and EPROMs. The future of memory technology, and the part that charge coupled and bubble domain memory devices may play, is also thoroughly reviewed. Additionally included are National Semiconductor's reliability report listing and programs, definitions of frequently used acronyms and excerpts from proposed IEEE standards.

Page Count: 256 Price: $11.00 Year: 1979

MOS DATABOOK*

The MOS Databook presents 816 pages about COPS™ devices and application information for MOS ROMs, speech synthesis, standard and custom MOS/LSI components.

Fabricated from NMOS, CMOS, and PMOS processes, these devices provide the most cost-effective solution to a system need.

The major emphasis is placed on standard circuits and their use in consumer telecommunications and data processing applications.

Page Count: 816 Price: $6.00 Year: 1980

NSC800 MICROPROCESSOR FAMILY HANDBOOK*

Contained in this manual are 224 pages of design-related information about National Semiconductor's 800-family series of high-performance/low-power microprocessor components.

Included are hardware functions, software operations, system support and design considerations for the NSC800 CPU, the NSC810 RAM I/O Timer, and the NSC830 ROM I/O.

Completing this current edition are data sheets, application notes, and physical dimensions for many of the NSC800 components fabricated using the P^2CMOS process.

Page Count: 224 Price: $5.00 Year: 1980

OPTOELECTRONICS HANDBOOK

Discrete LED lamps, multidigit LED numeric arrays and displays, and various custom LED arrays and interface components are catalogued and cross referenced in the 144 page edition of the Optoelectronics Handbook.

Included are absolute ratings, electrical and optical characteristics, recommended array processing, and custom options for this broad line of visible light emitting diodes (LEDs).

Additionally, there is preliminary data for new integrated displays that combine state-of-the-art ICs with the latest in display/readout devices, i.e., bargraph arrays with drivers, 0.3″ and 0.5″ displays with serial drivers.

Page Count: 144 Price: $3.00 Year: 1979

PRESSURE TRANSDUCER HANDBOOK

This is the 144 page handbook of integrated-circuit pressure transducers from National Semiconductor. In addition to complete specifications and a quick selection guide for National's IC transducer products, this edition includes comprehensive information of transducer theory, device structure, reliability and in-depth application data. To improve accuracy in any application, information about circuits designed utilizing the autoreference compensation is thoroughly covered.

Page Count: 144 Price: $3.00 Year: 1977

RELIABILITY HANDBOOK

This 832 page text is addressed not only to reliability specialists, but to designers, specifiers, program managers, and procurement specialists to whom semiconductor reliability is of vital concern.

The first section is a general overview of semiconductor devices, examining tests that include electrical, mechanical, environmental, and visual tests.

Thoroughly explained are the 883B and 883S RETS requirements and their relationship with linear, hybrid, interface, data acquisition, microprocessor and memory, CMOS and bipolar logic high reliability microcircuits made by National Semiconductor.

The handbook is voluminously documented and comprehensively cross referenced.

Page Count: 832 Price: $20.00 Year: 1979

SERIES/80 BOARD LEVEL COMPUTER STARPLEX™ DEVELOPMENT SYSTEM DATABOOK

This databook provides 224 pages of summary information on the complete line of SBC compatible board and system level microcomputer products, as well as information about the National Semiconductor STARPLEX™ development system.

Photos, product overviews, and specifications comprise over 50 BLC and RMC data sheets presented.

The STARPLEX™ Development System section is user-oriented. Featured are the disc operating system, FORTRAN IV and BASIC, the text editor, and options like the IN-SYSTEM EMULATOR™ and STARLINK™. CPU instructions and National Semiconductor training courses conclude the databook.

Page Count: 224 Price: $5.00 Year: 1980

VOLTAGE REGULATOR HANDBOOK

With the variety of fixed and variable regulator technology currently available, the 272 page Voltage Regulator Handbook becomes a must for the selection of three-terminal and dual tracking components that meet the system requirement while utilizing the most cost-effective approach.

Beginning with product selection procedure and a data sheet summary, the text continues with easily accessible information about booster circuitry, power transformer and filter specifications, test methods, manufacturers' cross reference, and extended use applications for National's regulators.

Page Count: 272 Price: $7.00 Year: 1980

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